

Catalog E-21

1937-?

PHOTO- MICROGRAPHIC EQUIPMENT



BAUSCH & LOMB
OPTICAL COMPANY , , ROCHESTER, N. Y.

359/363



An Institution Dedicated *to the* Service of Science

AS Science and Industry have pioneered new fields, the Bausch & Lomb Optical Co. has kept pace by pioneer work in optics, both design and construction, so that as needs arise they may be filled.

From its inception in 1853, the ideal back of each product of the company has been, "The user must have the satisfaction of knowing that no finer product is available."

To render better and more complete service, the Bausch & Lomb Optical Co. has assumed the responsibilities that came with leadership. In many cases this has meant developing new manufacturing methods, such as the introduction of power lens grinding equipment in America. In others, it has been necessary to control raw materials, as, for instance, the establishment and continued operation of an optical glass plant, so that the limits established by theory can be more fully realized in practice.

Today, whether it be an instrument wherein optics is applied in education, in the advancement of science or industry, or in the conservation of human vision, as exemplified by the Orthogon Lens, each product of the Bausch & Lomb Optical Co. is backed, not only by America's foremost optical institution, but also by over 80 years of experience in holding to the ideals that have made it such.

The illustrations in this catalog show Bausch & Lomb scientific instruments of current production. However, due to our constant efforts to improve and refine, this company reserves the right to supply apparatus that may differ in unimportant or minor details from those shown in the illustrations.

PHOTO- MICROGRAPHIC EQUIPMENT



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Table of Contents

	Page
Factors in Photomicrography	4
The Microscope	
The Objectives, Eyepieces and Condensers	
The Illumination	
The Mechanical Factors	
K Camera	6
J Equipment	7
H Camera	8
R Equipment	9
GBP and GBVP Equipments	10
Photomicrographic Microscope	13
DDE Microscope	14
The Euscope	15
The Ortho-Stereo Camera	16
Accessories for Low Power Photomicrography	18
Optical Accessories—Objectives	20
Eyepieces	21
Substage Condensers	22
Ultra-Violet Optics	24
Miscellaneous Accessories	26
Terms and Branches	28
Other Products	29

Factors in Photomicrography

Because of its inclusive and intimate contact with the educational and industrial fields, Bausch & Lomb Optical Co. has been able to design a complete line of coordinated photomicrographic equipments in which the operating needs of the worker are fully supplied, whether it be low or medium powers for routine recording, or a delicate research that taxes the resolving power of the finest optics.

Photomicrography is used to advantage in every field wherein the microscope is employed. It supplements visual observation of every kind. For the teacher, it provides a ready means for acquiring and presenting valuable didactic material. Notebooks and laboratory records of both elementary and advanced work are enhanced by photomicrographs. Announcements and dissemination of research findings are

clarified by suitable photomicrographic illustrations. In many industrial applications of the microscope, a photomicrographic record is made a part of every observation.

To anyone familiar with the operation of the microscope and able to use it efficiently in visual work, photomicrography is comparatively simple with modern equipment and material.

There are a few features, however, that deserve special mention as being essential in securing results of the highest character and utilizing the complete capability of the B&L optical equipment now available. These features also add speed, convenience, and certainty to the work.

The Microscope

The selection of a suitable microscope stand is important. Because

of the greater rigidity and range of adjustments, one of the larger research stands is recommended. Special attention should be given to the fine adjustment. Movement must be slow to permit accurate and convenient focusing in critical work.

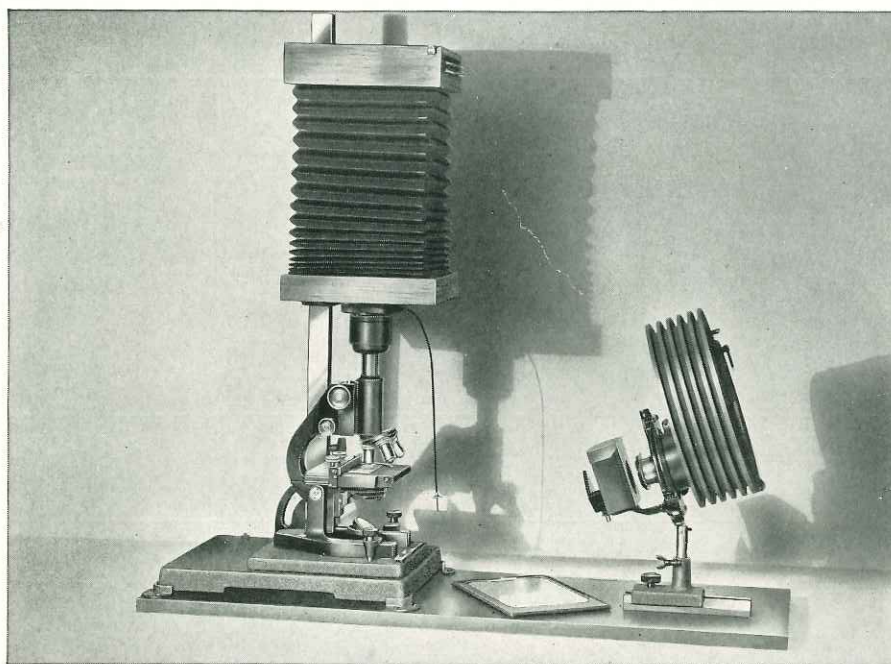
The Bausch & Lomb Research Microscope DDE and the Special Photomicrographic Microscope are suitable for work of the highest class with all powers. If low and medium power work only is to be done, any sturdy and mechanically fine stand will be adequate.

The Objectives, Eyepieces and Substage Condensers

Selection of proper optical equipment, objectives, eyepieces and condensers, is very important. Apochromatic objectives with Compensating or Ampliplan eyepieces are naturally first choice for critical work where the utmost in resolution and color correction is required. Fluorite objectives with either Hyperplane or Ampliplan eyepieces are satisfactory where requirements are slightly less exacting. Achromatic objectives, preferably employed with Hyperplane eyepieces for the medium and higher powers, can be used for a wide variety of useful recording if properly handled and due attention is given to their limitations.

To utilize the finer correction of Apochromatic objectives, and to enjoy the advantage of their larger numerical aperture, the use of a corrected substage condenser is advised. Either the Aplanatic Condenser of 1.40 N.A. or the Achromatic of 1.40 N.A. is recommended. Fluorite objectives also will give better results with either of these,

The Tungsten Arc Lamp as used with the Type R Photomicrographic Equipment.



and the performance of medium and high power Achromatic objectives improved.

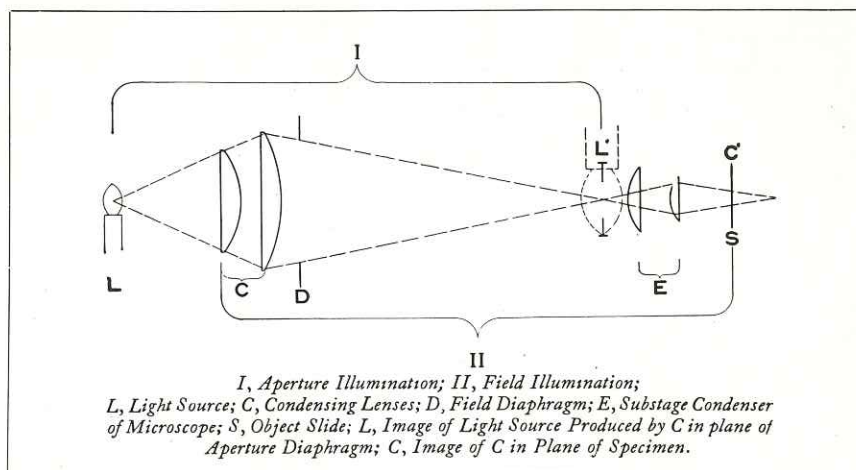
For use in natural color photography in which there is the necessity to meet special conditions as to color image size, Apochromatic objectives and Compensating eyepieces are recommended.

The Illumination

Every microscopist realizes the importance of proper illumination in rendering his object visible. The human eye will tolerate or compensate for deficiencies in illumination in a way that the photographic plate will not. Hence, a suitable illuminant properly employed is essential.

In every case, "critical illumination" is desirable. This consists of forming an image of the illuminant by the substage condenser in the same object plane as that on which the objective is focused. Another requirement of critical illumination is that light be sent through the object at such an angle that the entire back lens of the objective is filled. In many cases, however, because light sources of high intrinsic brilliance are small, the use of the substage condenser alone does not illuminate the entire field. To overcome this deficiency, the Kohler method of critical illumination is employed. A magnified image of the illuminant is formed approximately in the plane of the rear lens of the substage condenser which completely covers its area.

This is shown diagrammatically above. The light source, indicated as a candle, is imaged by the condenser "C" in the large lens of the substage condenser "E." Condenser "C" represents any condenser placed in the lamphouse for collecting and concentrating the light at the source. From the figure it is seen that the lenses of condenser "C" are completely filled and, accordingly, that the field is evenly illuminated. In this way, condenser



"C" becomes, in effect, the light source for condenser "E" which can be focused critically in the plane of the object. This adjustment is easily made in practice. The microscope is first focused on the object. Then the substage condenser is focused on the same plane, so that the diaphragm at the lamphouse condenser will be seen superimposed.

The choice of illuminant will depend upon the current available. Wherever possible, we recommend the Tungsten Arc shown on page 4. In this lamp, the light source is the solid circular disc tungsten electrode, located in the center of an annular ring electrode. To start the arc, mercury is vaporized by a heating filament. This mercury vapor permits current to flow between the tungsten electrodes. Once established, the arc maintains itself and the solid tungsten electrode becomes a homogeneous light source of high intensity. It has approximately $2\frac{1}{2}$ times the brilliance of the ribbon filament, 6-volt, 108-watt incandescent bulb. The tungsten arc bulb has the additional feature of longer life. Tests indicate that it has a useful life of at least 150 hours. At that time, its photographic intensity was reduced by only about 50%, so that it still served as a satisfactory source. This bulb must be operated from an A.C. line through a special automatic transformer.

Other lamps suitable for photomicrography are the 6-volt, 108-watt Mazda with ribbon filament, and the Mechanical Feed Arc. The 6-volt, 108-watt Mazda can be used on any A.C. line through a transformer. Where only direct current is available, the arc lamp is recommended.

The Mechanical Factors

The mechanical requirements of camera construction and design of the optical bed are relatively simple, but very exacting. Attention must be given to each feature that contributes to rigidity and freedom from vibration. All adjustments must be smooth, easily effected, and easily held. Attention must be given to proper alignment. The focusing screen and photographic plate must be at right angles to the optical axis. All of these requirements are met in the Bausch & Lomb photomicrographic apparatus listed herein. A complete range of equipment is shown so that the needs of workers in every field are fully supplied.

No general recommendations as to exposure, sensitive materials or color filters are possible. Much depends upon the character of the object and the results demanded. There are several manuals or textbooks on photomicrography which serve as a very useful supplement to actual practice and operating experience.

K CAMERA

Vertical, Plate Size, 3¼" x 4¼"

The K Camera has become one of the most popular equipments for routine photomicrographic work. It is simple in design, easily set up and may be used with any conventional type of microscope which is fitted with a substage condenser.

Camera Construction

The camera consists of a tapered metal dark chamber of fixed length supported by a bracket from a vertical rod attached to the metal base plate. The length of the dark cham-

ber gives the same magnification photographically as the microscope gives when used visually.

The camera includes an exposure shutter which may be set for bulb, time and instantaneous exposures. It is equipped with a double plate holder for 3¼" x 4¼" plates, a size easily covered with the popular power eyepiece. Double, cut film holders or film pack adapters are also available.

The locating camera collar, attached to the vertical supporting rod, and the adjustable plate, attached to the 9" x 10" camera base for locating the microscope, aid aligning camera and microscope.

If either the camera or microscope is removed from its normal position, quick realignment is effected by these locating parts.

The Observation Eyepiece

The observation eyepiece not only permits focusing the specimen in the plane of the photographic plate, but allows visual observation of the specimen while the microscope is connected with the camera, and during exposure. The effect of various color filters and character of illumination may be studied without harmful glare or intensity affecting the delicacy of the observation. Moving objects and most favorable fields may be located. These advantages are available because a beam splitting prism is used.

So little light is deflected into the side focusing tube that exposure time is not appreciably influenced. The additional time is less than the error ordinarily made in determining exposures.

For the very exceptional thick or dense specimen, the beam splitting prism may be used in the same way as an ordinary right angle reflecting prism, that is by simply pulling it out of the light path.

For those accustomed to working with images on the ground glass, a focusing screen is provided. This permits use of the K Camera in the conventional manner.



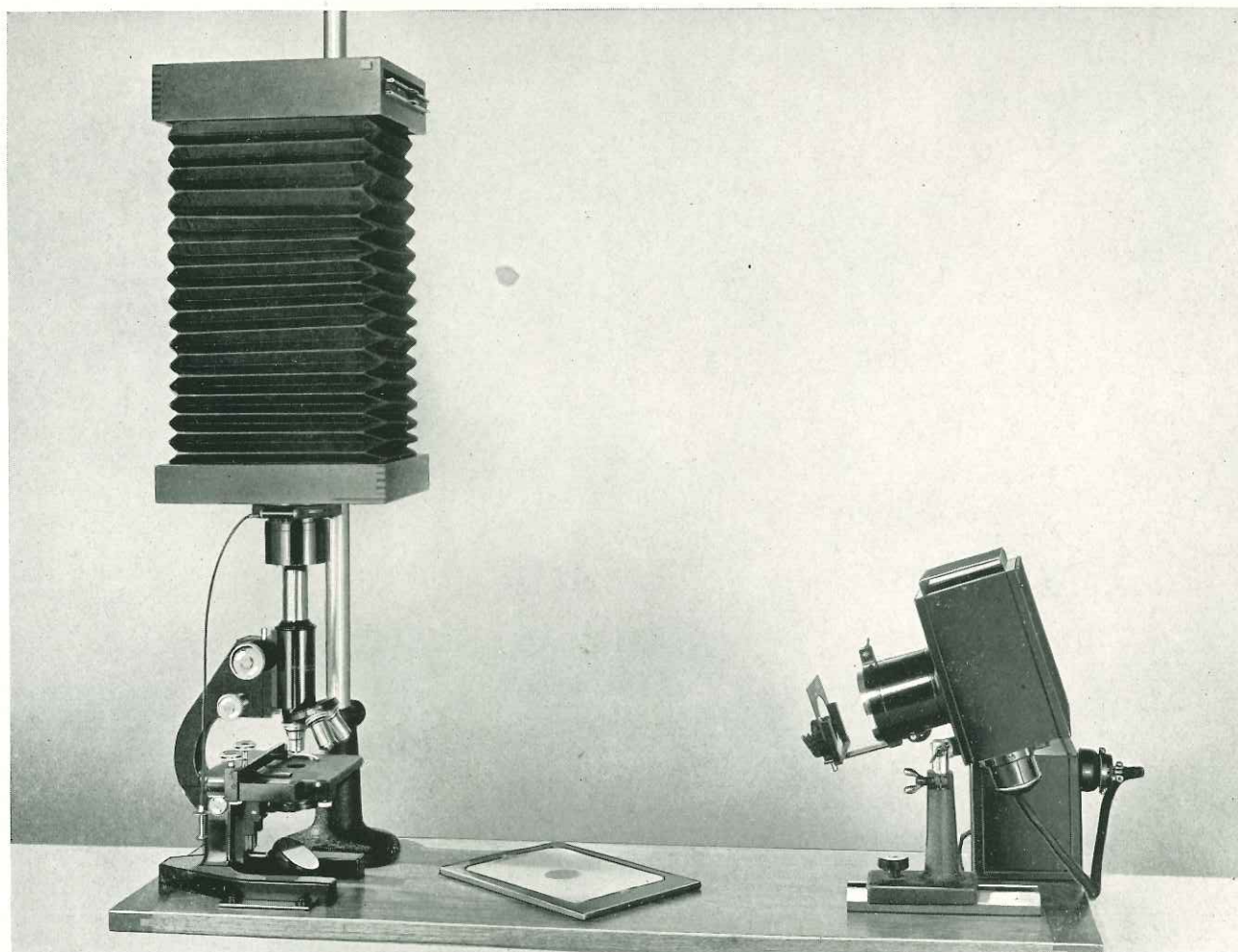
Type K Camera, HA Microscope and Adjustable Microscope Lamp with filter holder.

Description	Catalog No.	Code Word
Photomicrographic Camera, Type K, with light tight connector, ground glass focusing screen, 3¼" x 4¼" double plate holder, shutter, and observation eyepiece	42-14-44-11	Cases
Cut Film Holder.....	42-15-39	Casit
Film Pack Adapter.....	42-15-38	Casov
Adjustable Microscope Lamp with spherical* condenser in rack and pinion focusing mount, 6-volt, 108-watt ribbon filament Mazda bulb and transformer for 115-volt, 60-cycle A.C.....	42-44-97-66	Caopg
Filter Holder.....	42-47-23	Chaxr

*Aspheric Condenser, \$8.50 extra. For Filters, see page 26; Arc Lamps, see page 27.

J Photomicrographic Equipment

Vertical and Horizontal—Plate Size, 5" x 7" and Smaller



Type J Photomicrographic Equipment with compound shutter and HA Microscope.

The J Photomicrographic Equipment is complete, including the vertical camera and illuminating unit mounted on a common supporting base. The camera has a maximum bellows extension of 24".

The vertical bar supporting the camera centers it over the microscope. By releasing a thumb screw in the pedestal base, the camera may be quickly swung aside for visual observation. In this position, it may also be used with the Micro Tessar lenses for photographing gross specimens.

Adjustable guide plates attached

to the supporting base hold the microscope in place once it is aligned with the camera.

The J camera, including supporting rod and pedestal base, may be purchased separately.

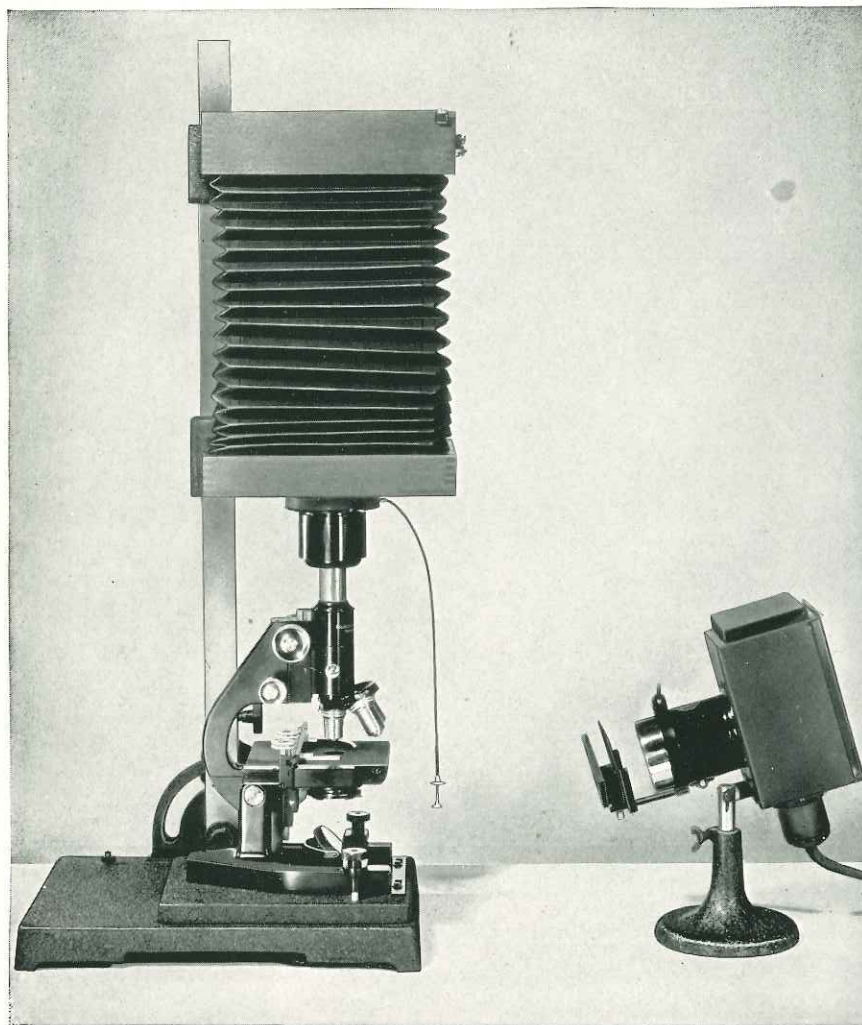
Description	Catalog No.	Code Word
Photomicrographic Equipment, Type J, mounted on a base board 12 x 36 inches, and including light tight connector, ground glass focusing screen, double plate holder for 5 x 7" with kits for 4 x 5", and 3 1/4 x 4 1/4" plates, illuminating unit with aspheric condenser, 60 mm in diameter, in rack and pinion focusing mount, filter holder, and 6-volt, 108-watt, ribbon filament Mazda bulb with transformer for 115-volt, 60-cycle A.C.	42-14-36-05	Caacp
Camera, same as above, but without base board and illuminating unit.....	42-14-36-01	Calim
Compound Shutter.....	42-16-32	Caajw

NOTE: For Filters and accessories, see page 26.

OPTICAL COMPANY

H C A M E R A

Horizontal and Vertical—Plate Size, 5" x 7"
and Smaller



*Type H Photomicrographic Camera, compound shutter, HSA
Microscope and Adjustable Microscope Lamp with filter holder.*

Description	Catalog No.	Code Word
Photomicrographic Camera, Type H, including a light tight connector, ground glass focusing screen, double plate holder for 5 x 7", with kits for 4 x 5", and 3 1/4 x 4 1/4" plates.....	42-14-14-07	Caard
Compound Shutter (see page 26 for description).....	42-16-32	Caajw
Adjustable Microscope Lamp, with aspheric condenser and 6-volt, 108-watt, ribbon filament Mazda bulb, and transformer for 115-volt, 60-cycle A. C.	42-44-97-65	Cezim
Filter Holder.....	42-47-23	Chaxr

NOTE: For filters and accessories, see page 26; Arc Lamps, see page 27.

The Type H Camera is the most adaptable of the small cameras, since it may be used in either a horizontal or vertical position. Because of its adaptability, it has come to be considered as the standard camera for general photomicrographic work.

Camera Construction

The camera is carried on a graduated bar of rectangular cross section, which is attached to the base by an inclination joint. When the camera is used in a vertical position, approximately 20" of the bellows draw may be used, or in the horizontal position the full 24" is available. The camera bar, of two-piece construction, has a swivel and thumb-screw near the inclination joint to permit the camera parts to be quickly swung aside for visual work. The camera may also be used in this position for gross photography and a full 24" of bellows extension may be used for this work. The camera front has a removable lens board with flange carrying the light-tight chamber for connecting to the microscope. A compound shutter facilitates making exposures and a rack and pinion focusing mount for focusing Micro Tessar lenses may be mounted on the front board.

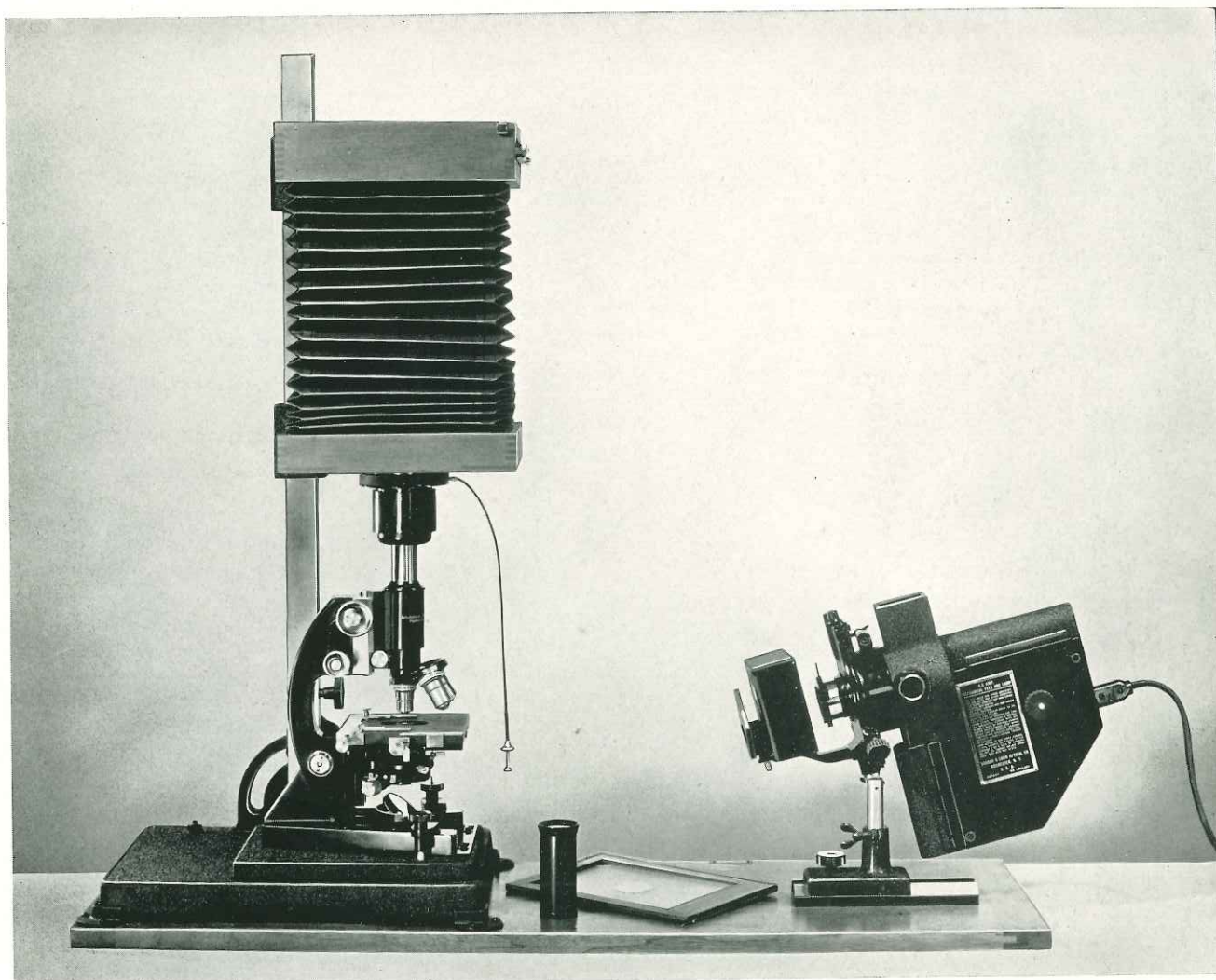
The camera back accommodates the ground glass focusing screen, with clear center, interchangeable with the double plate holder.

Heavy Cast Base

The heavy cast-iron camera base is 10" x 13" upon which is a leveled platform for carrying the microscope. The weight of the base is sufficient to prevent the equipment being over-balanced when the camera is in a fully extended horizontal position. Once the microscope is aligned with the camera, two clamps hold it rigidly in position.

R Photomicrographic Equipment

Vertical and Horizontal—Plate Size, 5" x 7"



The Type R Photomicrographic Equipment is a convenient and adaptable arrangement, consisting of the H Camera, described on the opposite page, and an illuminating unit mounted on a common support. The illuminating unit consists of a high aperture condenser in focusing mount, cooling cell and filter holder mounted on an inclination joint support. Three lamps are listed—an incandescent ribbon filament, a tungsten arc, and a carbon arc lamp. These are attached to the condenser support by means of a centering collar which facilitates centering the source.

Type R Photomicrographic Equipment with compound shutter and the GGB Microscope.

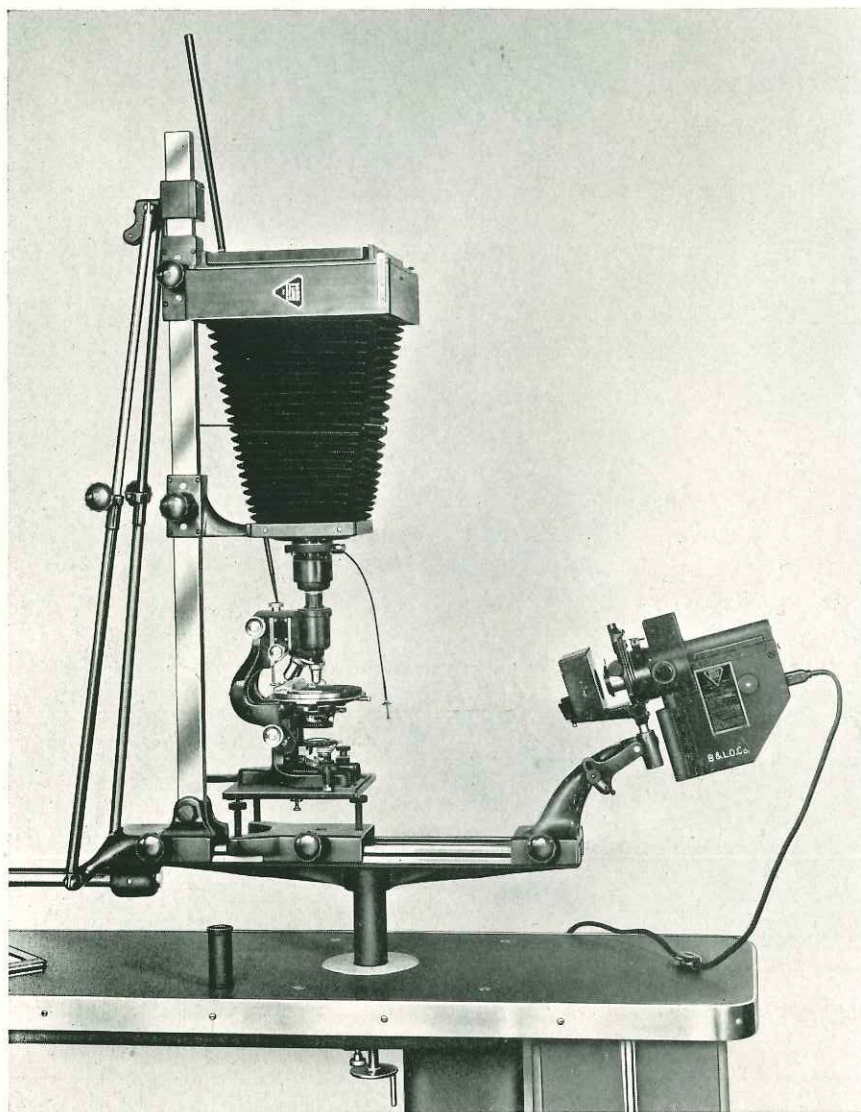
Description	Catalog No.	Code Word
Photomicrographic Equipment, Type R, consisting of Type H Camera, 12 x 36" baseboard; focusing magnifier, and illuminating unit with double lens condenser, water cell and filter holder, 6-volt, 108-watt ribbon filament Mazda bulb, with transformer for 110-volt, 60-cycle A. C.	42-14-14-37	Caavh
Photomicrographic Camera, same as above, except with Automatic Arc Lamp and 4.5-ampere rheostat, for 115 volt D. C.	42-14-14-27	Caaxk
Photomicrographic Camera, same as above, except with Tungsten Arc Lamp and transformer for 115-volt, 60-cycle A. C., described on page 26	42-14-14-92	Chays
Compound Shutter, (see page 26)	42-16-32	Caajw

NOTE: For filters and accessories, see page 26.

OPTICAL COMPANY

GBP AND GBVP EQUIPMENTS

Horizontal and Vertical—Plate Size, 8" x 10"



GBVP Photomicrographic Equipment in vertical position, with DDE Research Microscope, and Automatic Feed Arc Lamp.

This equipment is ideal for research work as carried on by educational institutions, hospitals, and industrial plants. It is the ultimate choice where the convenience of complete adaptability to different

types of work is necessary—where positive, rigid alignment of light source, microscope, and camera helps speed the work of the operator in producing fine photomicrographs.

The equipment consists of a stable

metal support carrying the microscope plate, illuminating unit and camera.

It is made in two types, the GBP equipment which is fixed for working in a horizontal position, and the GBVP, having an inclination joint which permits the camera to be used in the vertical as well as horizontal position.

The Camera with All-Metal Back

The camera consists of a tapering 40" extension bellows with a center support which prevents the bellow's sagging. An innovation in camera design is the all-metal back with a reversible support for the plate holder. The equipment includes a single book type plate holder to accommodate 8 x 10", 5 x 7", 4 x 5" and 3 1/4 x 4 1/4" plates, one ground glass focusing screen with clear center, one clear glass focusing screen with graduated cross lines, exposure shutter, light-tight connector for connecting with the microscope, and a focusing magnifier.

The camera is supported by a rectangular graduated bar—rectangular so that the camera remains in position even when the clamps are not tightened. Smoothness in camera movement is attained by the extra long bearing surfaces of the camera supports.

The Adjustable Microscope Support

The microscope plate accommodates practically any type of microscope. It is adjustable for height and provided with screws for

leveling. Clamps and guide plates are provided to hold the microscope in position. An extension focusing device permits focusing the microscope from the back of the camera.

The Adjustable Microscope Lamp

The illuminating unit is mounted on the same bed which carries the microscope plate. Thus, the illuminating unit and microscope plate are an integral part, and permanency of the alignment between the two units is assured. Both of

these parts move backward and forward on the bed and can be clamped in any desired position.

The illuminating unit consists of a heavy cast iron support holding lamp, condenser, and water cell with Wratten filter holder. The condenser is of short focal length and large aperture (approximately f.1.0) well corrected for spherical aberration. The image is well defined and of sufficient size to fill the entire aperture of the substage condenser. The condenser includes an iris diaphragm focused by a rack and pinion movement.

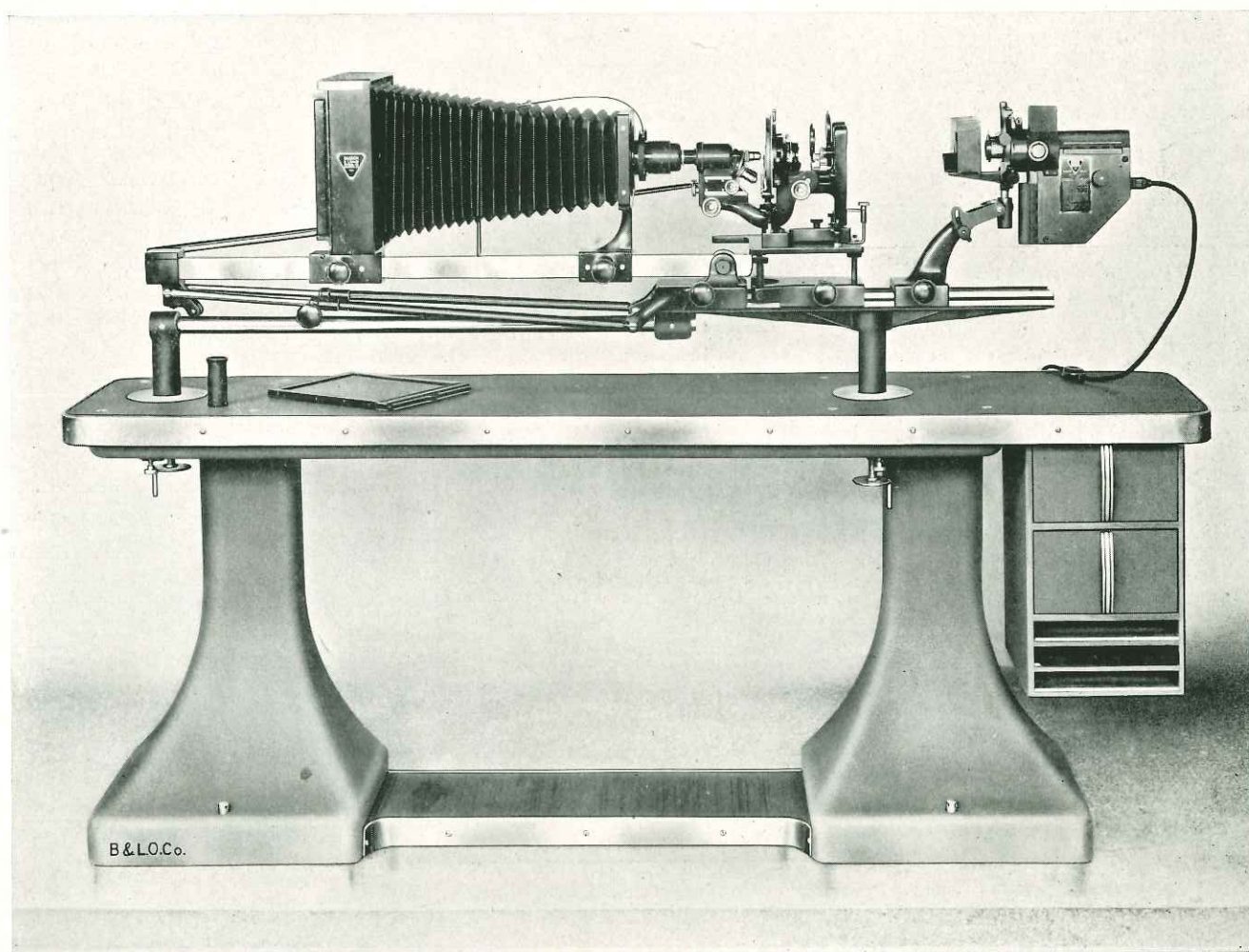
An adjusting mechanism permits

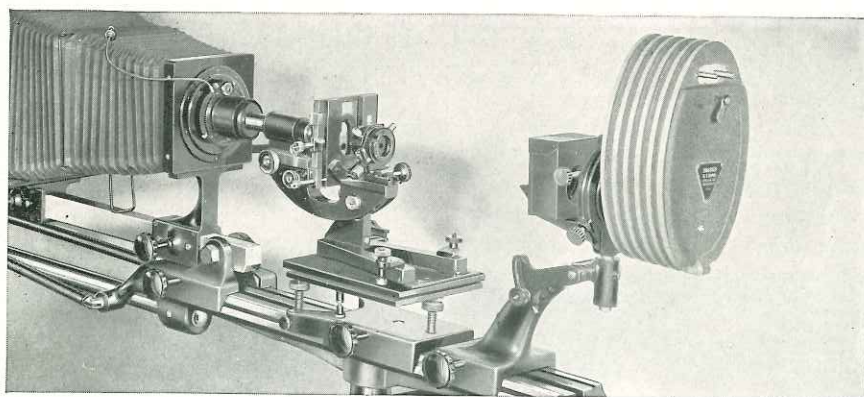
the adjustment of the light beam in three planes, although this equipment is properly aligned before leaving the factory and need not be changed.

Recommended Microscopes

For use with the Horizontal Camera (GBP) we recommend our special Photomicrographic Microscope, which is adaptable to the entire range of high and low power work. This can be equipped with a wide assortment of eyepiece and ob-

*GBVP Photomicrographic Equipment in horizontal position, with
DDE Research Microscope and Automatic Arc Lamp.*





*The Tungsten Arc Lamp, as used on the GBVP
Photomicrographic Equipment.*

jective combinations, and necessary substage equipment.

For use with the combined Horizontal and Vertical Camera (GBVP) we recommend one of the conventional type microscopes, such as the DDE, (see page 10). Although designed essentially for visual work, it is satisfactory for the finest work in photomicrography.

For Macro and Gross Work

The GBVP Cameras were developed primarily for photomicrography, but nevertheless are readily adapted to gross photography, copying, and enlarging.

For this work, either our anastigmatic photographic lens or Micro Tessar lens should be used. For

gross photography, the instrument may be used in either the vertical or horizontal position. (See page 18 for accessories for photo-macrography). Complete information and recommendations as to the proper lens to use, as well as the arrangement for holding the material to be photographed, will be furnished upon receipt of information concerning the size and nature of the material and the magnification required.

The Vibration Absorbers

For extreme conditions of high magnification or excessive vibration, the use of vibration absorbers is essential. These consist of spring suspensions with adjustable clamping devices. A convenient lever permits releasing the equipment from the action of the springs whenever the spring suspension is not needed. When used for gross photography, where the specimen is not mounted on the same support with the camera, the locking lever will prove very convenient to stop relative movement between the camera and the object.

The vibration absorbers are mounted permanently in the table.

The Supporting Stand

The Supporting Stand provided for the GBP Camera is constructed on a heavy, cast-iron base with levelling screws, casters, and provision for holding the transformer or rheostat. The top of the table is covered with a durable composition material. At one end is a two drawer cabinet for accessories and compartments for plate holders and focusing screens.

Description	Catalog No.	Code Word
Photomicrographic Equipments GB and GBV consist of the metal support carrying the microscope plate, illuminating unit and camera. Supplied with the microscope plate is an extension fine focusing device. The illuminating unit, as indicated in the listings below, includes also the necessary condenser, water cell and filter holder. The camera includes a compound shutter, light tight connector, ground glass and clear glass focusing screen, focusing magnifier and single book-form plate holder to accommodate 8 x 10", 5 x 7", 4 x 5" and 3 1/4 x 4 1/4" plates.		
For Horizontal Use Only		
GBPAA with Mechanical Feed Arc Lamp and resistance for 115-V. D.C.*	42-14-07-35	Caorh
GBPT with Tungsten Arc Lamp and resistance for 115-V. A.C.	42-14-07-92	Chazt
GBPR with 6-volt 108-watt ribbon filament Mazda bulb and transformer for 115-V. 60-cycle A.C.	42-14-07-10	Caotk
For Horizontal or Vertical Use		
GBVPAA with Mechanical Feed Arc Lamp and resistance for 115-V. D.C.*	42-14-08-35	Caosj
GBVPT with Tungsten Arc Lamp and transformer for 115-V. A.C.	42-14-08-92	Chebv
GBVPR with 6-volt 108-watt ribbon filament Mazda bulb and transformer for 115-V. 60-cycle A.C.	42-14-08-10	Caovl
Supporting Stand		
Supporting Stand with vibration absorbers and cabinet for accessories and plate holders.	42-16-59	Chocz
*For use on A.C. an 8-ampere resistance is recommended. Price \$2.25 extra.		
NOTE: For filters and other accessories see page 26.		

The Photomicrographic MICROSCOPE

The Photomicrographic Microscope was designed to offer the greatest convenience and adaptability in an instrument of positive rigidity. It simplifies the handling of low power as well as high power work. It is quickly adapted to any conditions indicated by the nature of the specimens.

The body tube, stage and mounting for the substage are all supported by a single heavy cast-iron base.

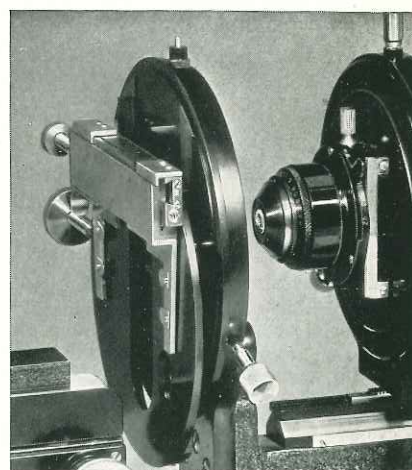
The body tube is $2\frac{1}{2}$ inches inside diameter and $1\frac{3}{4}$ inches long. The large diameter makes it possible to utilize the full available field of the Micro Tessar lenses. It is supplied with an eyepiece adapter for using the standard microscope eyepieces, and provision for taking any one of the revolving or centering nosepieces for the standard microscope objectives. Quick interchange from the use of eyepieces and microscope objectives to Micro

Tessars, which do not require eyepieces, is provided by a special bayonet construction for attaching the eyepiece adapter.

An unusual construction permits the interchangeable use of a plain, square stage with the conventional mechanical stage, or a circular revolving mechanical stage. The plain square stage is $5\frac{1}{2} \times 4\frac{3}{4}$ ", designed in the form of a horseshoe with interchangeable "U" shaped center sections having openings of 1", 2" and 3" to permit photographing the full fields covered by the Micro Tessar lenses.

The circular revolving mechanical stage is designed to fit in the place of the "U" shaped centerpiece of the plain stage, and easily slides into position. It is centerable, with built-in stage movements graduated in millimeters, with verniers.

The substage is moved along its wide, dovetailed track by means of

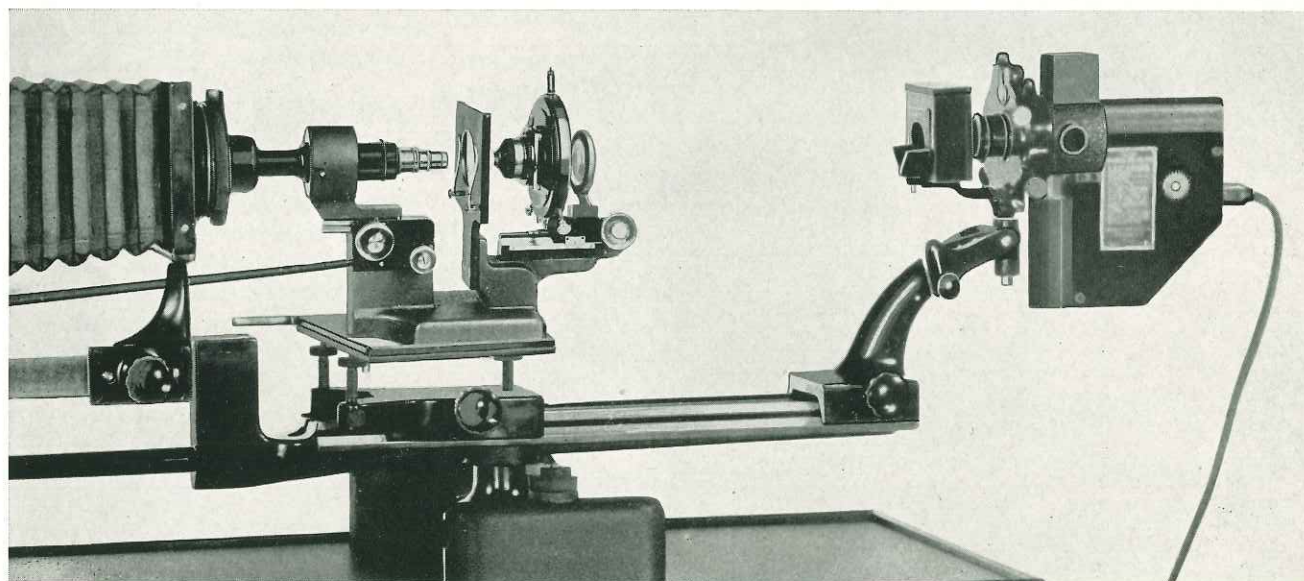


The Circular Stage of the B & L Photomicrographic Microscope.



The 3 inch Substage Condenser.

The Bausch & Lomb Photomicrographic Microscope, as used on the GBP Photomicrographic Equipment.



a heavy rack and pinion mechanism. The range of movement greatly exceeds that of a standard microscope substage, and, by means of a graduated scale, the exact location of the condenser for each objective can be recorded. The rack and pin-

ion carries a large ring with centering adjustments, to hold the optical parts—the 3" condensing lens for Micro Tessar work or the regular Aplanatic microscope condenser.

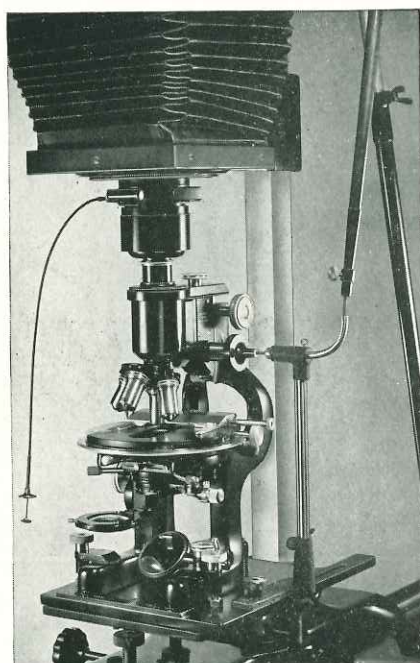
The Aplanatic condenser has an iris diaphragm, graduated to show

the diaphragm opening in millimeters. An auxiliary substage condenser on a swinging arm can be introduced into the light beam whenever low power objectives are to be used with the regular Aplanatic substage condenser.

The 3" condensing lens for Micro Tessar work fits into the centering ring. It is necessary to use this lens whenever the full available field of the 72mm Micro Tessar lens is needed.

This photomicrographic microscope will also be found very useful for projection and drawing.

Description	Catalog No.	Code Word
Photomicrographic Microscope, as described, including plain rectangular stage, Aplanatic condenser with graduated diaphragm for use on high power objectives, and 3" condensing lens for Micro Tessars, but without objectives, eyepieces, or Micro Tessars.....	42-18-48-12	Caduh
Same as above, but with revolving, mechanical stage only	42-18-48-45	Chefz
Mechanical Stage for square stage microscope.....	31-59-59	Ajils



The Remote Control as supplied with a GBVP Camera connected with the DDE Microscope.

DDE MICROSCOPE

For Visual Research or Photomicrography

The DDE Research Microscope is the most complete Bausch & Lomb microscope for visual research, yet it is designed to handle practically any work in photomicrography. It is unusually rigid and stable, having a one-piece stand, on which are mounted the stage, substage and body tube. This microscope will be found even more adaptable than the photomicrographic microscope, except for the size of field that can be covered by the Micro Tessar lenses.

It is equipped with an inclined binocular body tube for visual use, and a 50mm vertical monocular tube for photomicrography. The body tubes are easily and quickly interchanged.

The fine adjustment carries only the nosepiece and objectives, giving maximum rigidity even during long exposures in photomicrography.

The body tube has a standard tube length—160mm, so that regular Bausch & Lomb objectives and eyepieces are used. The usual revolving nosepiece may be used but the centering nosepiece is preferred.

The large circular revolving mechanical stage has movements in two directions, graduated in millimeters with verniers. The stage is centerable.

The rack and pinion substage is centerable, and has a graduated iris diaphragm that may be revolved and decentered. Aplanatic or Achromatic condensers, or the Micro Tessar condensers fit the dovetailed quick-changing slide.

The coarse adjustment, carrying the complete body tube assembly, can be racked off when it is desirable to use Micro Tessar accessories. This permits the use of the Micro Tessar rack and pinion focusing mount on the front of the camera, and the Micro Tessar substage condensers on the substage of the microscope.

For more complete details, see Catalog D-12.

Description	Catalog Number	Code Word
DDE Research Microscope, complete, as described above, with inclined binocular and vertical monocular eyepiece for visual work or photomicrography. The optical equipment includes the 10× (16mm), Achromatic, 43× (4mm) Fluorite, 93× (1.8mm—1.30 N. A.) Fluorite Objectives; 5× and 10× Huygenian Eyepieces; Triple Revolving Nosepiece; 1.40 N. A. Aplanatic Condenser.....	31-24-57-12	Adutm
Same as above, but with 10× (16mm), 45× (4mm), 90× (2mm 1.30 N.A.) Apochromatic Objectives; 7.5× and 12.5× Compensating Eyepieces; Triple Revolving Nosepiece; Achromatic Substage Condenser 1.40 N.A..	31-24-57-18	Aduvsn

THE EUSCOPE

For Photomicrography and Visual Observation

The B & L Exton Euscope is an apparatus which, when applied to any standard laboratory microscope, serves three distinct purposes—individual observation with both eyes, photomicrography and micro-projection.

Its use is of much value in laboratories where pictures of microscopic fields are taken, in schools where small student groups are instructed, or where microscopic examination of specimens constitutes a major part of the daily routine.

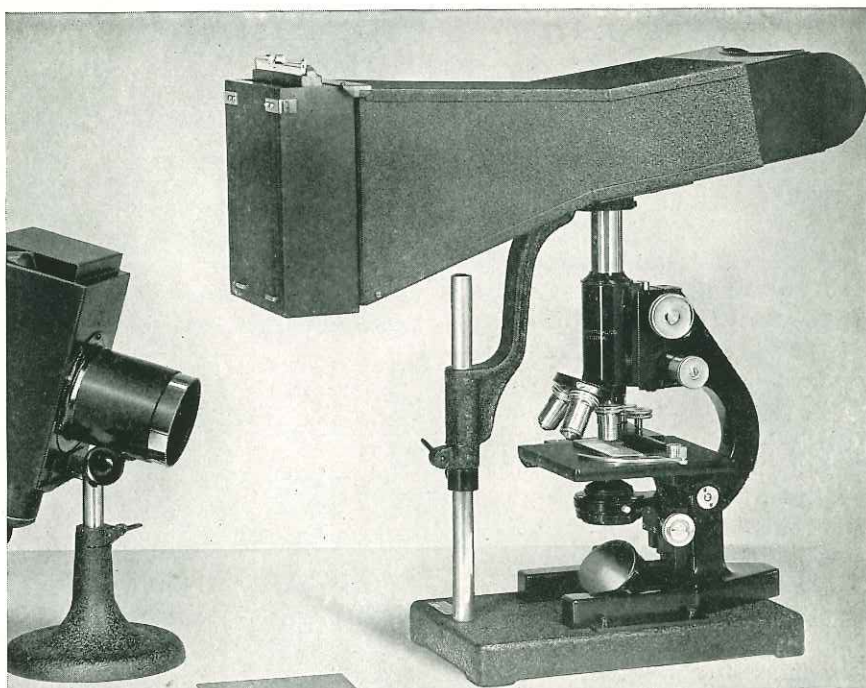
The Euscope is extremely simple to use, requiring no special training. A good laboratory microscope, such as one would use for visual work, may be used.

First, the microscope is approximately focused, then the Euscope viewing box on the adjustable arm should be lowered so that the prism of the Euscope will fit closely over the eyepiece of the microscope. Then, by looking in the eyepoint end, the image is brought into correct focus on the viewing screen.

The Camera Attachment

A camera attachment for the Euscope converts it into a photomicrographic camera for taking pictures of microscopical fields. The white opaque screen which comes with the Euscope is removed after the image has been focused upon it, and the camera attachment inserted in its place. This attachment takes standard 4 x 5 inch plates or cut films.

A felt covered shield is placed in the viewing box after the image is focused, to keep out stray light. A fairly strong light source should be used, such as that obtained from the 6-volt, 108-watt Adjustable Lamp



The Euscope, with camera attachment; HA Microscope and adjustable lamp.

or from the Arc Lamp. See page 27.

In schools, classes can take photomicrographs of specimens which

they observe and can soon build up a large file of photographic prints as permanent records.

Description	Catalog Number	Code Word
Euscope, as described, for individual observation with both eyes; (lamp, camera, and projection attachment not included)	42-63-66	Dilal
Photographic Attachment with plate holder for 4" x 5" plates or cut film	42-65-68-01	Cewok
Viewing attachment, for micro-projection with the Euscope	42-65-70-62	Cewul
Adjustable Microscope Lamp on base adjustable for height and inclination, spherical condenser in rack and pinion focusing mount and with 6-volt, 108-watt coil filament Mazda bulb, and transformer for 110-volt A.C.	42-44-97-09	Dhipf
Mechanical Feed Arc Lamp with inclination joint, on base adjustable for height, spherical condenser, with cord, plug and switch (without resistance)	31-33-81-03	Actez
Resistance, 4.5 amperes, for use with above lamp on 110-volt D. C. without cord	42-46-52	Cewag
Resistance, 8 amperes, for use with above lamp on 110-volt A. C. without cord	42-46-57	Cekoy

The ORTHO-STEREO Camera

Stereoscopic records at actual size
or magnifications up to 24X

The Bausch & Lomb Ortho-Stereo Camera makes stereoscopic photography at magnifications from 1 to 24X practical for routine use in science and industry. With this combination of camera and viewer, it is easy to make permanent photographic records of small objects that can be viewed with the same impression of solidity and verity as actual scale models. Details escaping notice in the best of non-stereoscopic photographs are seen easily and unmistakably. Small perishable objects, museum specimens, dissections, machine parts, objects in evidence, either civil or criminal, all come within the scope of this equipment. Frequently, accurate stereograms are more desirable for study, reference and interchange than the actual objects.

Co-ordinated Equipment

The Ortho-Stereo Camera is designed to make photographs which, when viewed in the Ortho-Stereo-scope, fulfill all requirements of true binocular vision. Each essential to true ortho-stereoscopic representation has been met.

Thus, the camera conditions, such as focal length of the lens, object and image distance, magnification, and distance between negative centers, have been considered in relation to the viewing conditions.

These include chosen image distance, focal length of viewing lenses, their separation and that of the finished prints.

Complete harmony between visual accommodation and conver-

gence, such as is present in normal and unaided vision, is attained. Stereograms taken and viewed with this equipment can be studied over protracted periods without discomfort and eye strain and with a satisfying impression of plasticity and three-dimensional effect.

Quickly and Easily Used

The Bausch & Lomb Ortho-Stereo Camera is so designed that all requirements of any of the six magnifications are met automatically, without computation, and with

The Ortho-Stereo Camera is quickly and easily focused.



practically no manipulation on the part of the operator.

Changing from one magnification to another requires only the substitution of one photographic objective, mounted on a slide, for another, and setting the dial on the camera to the magnification corresponding to that marked on the objective and slide combination in use.

Necessity for transposing prints for mounting, one of the serious handicaps in ordinary stereoscopic work, has been eliminated entirely.

General Features of the Camera

The Ortho-Stereo Camera is of the fixed focus type with fine adjustment, and may be used in either vertical or horizontal position. It is fitted with a double slide carrying a frame into which may be placed either the ground glass focusing screen or the standard 5 x 7" plate holder. Just below this slide, a cylindrical drum may be revolved to various stops, each stop corresponding to the ultimate magnification for which the camera is set. This limits the plate shift to the exact distance required for the magnification. The manipulation of this slide also causes the automatic transposition of the views between the exposures.

At the bottom of the camera chamber is mounted a photographic shutter, which may be adjusted for time, release, and instantaneous exposures of varying durations. Attached to this shutter is a dovetail

clamp into which the objectives are introduced and locked. Each objective is attached to an appropriate adapter, which has a slot of exactly the correct length to permit only the lateral motion required.

The Camera is of all-metal construction, the box of cast-aluminum, all parts are precisely fitted and every provision made for accuracy in use.

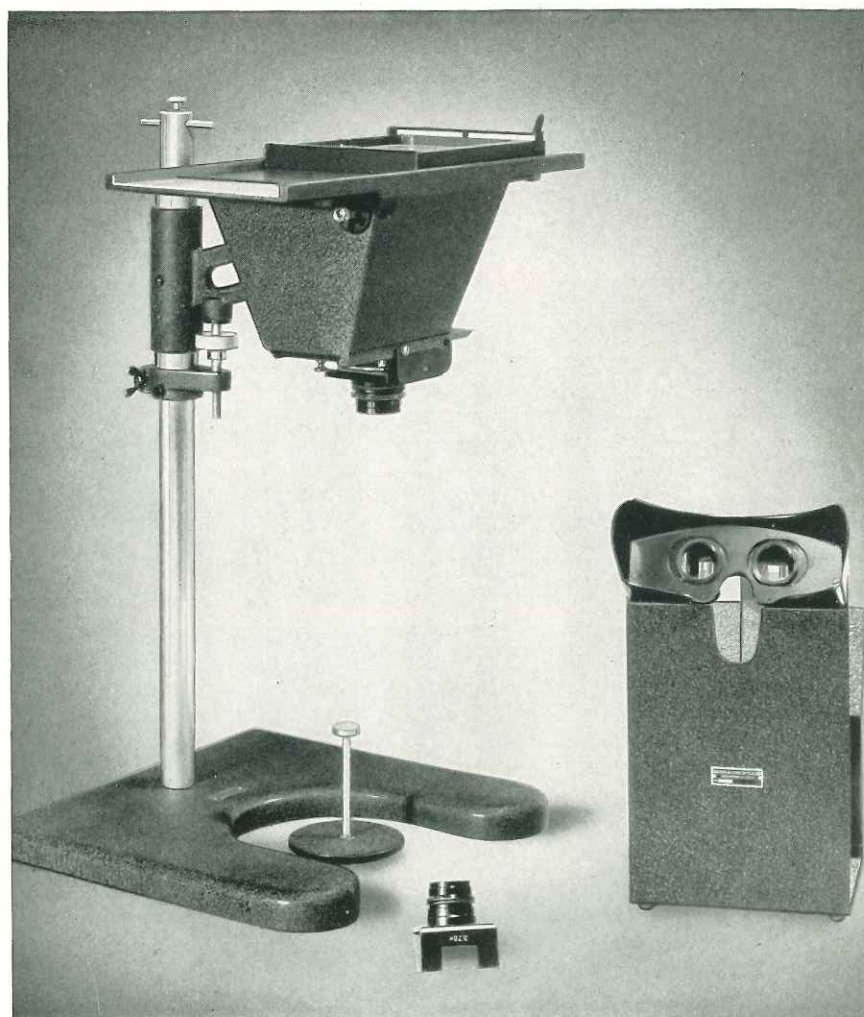
Finish is black enamel, crackle, and chromium-plating. The size of each picture making up the stereoscopic pair is 70 mm square. Positives are made at a single printing operation.

The Ortho-Stereoscope

The Ortho-Stereoscope is designed for viewing prints made with the Ortho-Stereo Camera. It consists of a stereoscope with adjustment for interpupillary distance, supported on a metal stand of proper height for convenience when viewing. The finish is of durable black crackle.

Range of Magnification

The Ortho-Stereoscope magnifies the stereogram $2.1\times$. Thus the ultimate magnification of the object



Ortho-Stereo Camera with lens in adapter and Ortho-Stereoscope.

when viewed with it will be equal to the product of the magnification due to the camera alone and the magnification due to the stereoscope.

The taking lens combinations provided are used to secure ul-

timate magnifications when viewed in the Ortho-Stereoscope, as shown in the table at left.

Suitable lens and slide equipment are listed separately for convenience in making up outfits especially adapted for the work to be undertaken.

Photographic Magnification	Ultimate Magnification When Viewed
0.49 $\times$	1.0 $\times$
0.82 $\times$	1.7 $\times$
1.79 $\times$	3.75 $\times$
3.14 $\times$	6.6 $\times$
5.24 $\times$	11.0 $\times$
11.42 $\times$	24.0 $\times$

Description	Catalog Number	Code Word
Ortho-Stereo Camera.....	42-14-60-23	Cexah
Ortho-Stereoscope.....	42-16-70	Cexik
1.0 $\times$ Lens and Adapter.....	42-16-71-01	Cexol
1.7 $\times$ Lens and Adapter.....	42-16-72-02	Cexum
3.75 $\times$ Lens and Adapter.....	42-16-73-04	Ceyaj
6.6 $\times$ Lens and Adapter.....	42-16-74-07	Ceyek
11.0 $\times$ Lens and Adapter.....	42-16-75-11	Ceyil
24.0 $\times$ Lens and Adapter.....	42-16-76-24	Ceyom

Accessories for Low Power Photomicrography

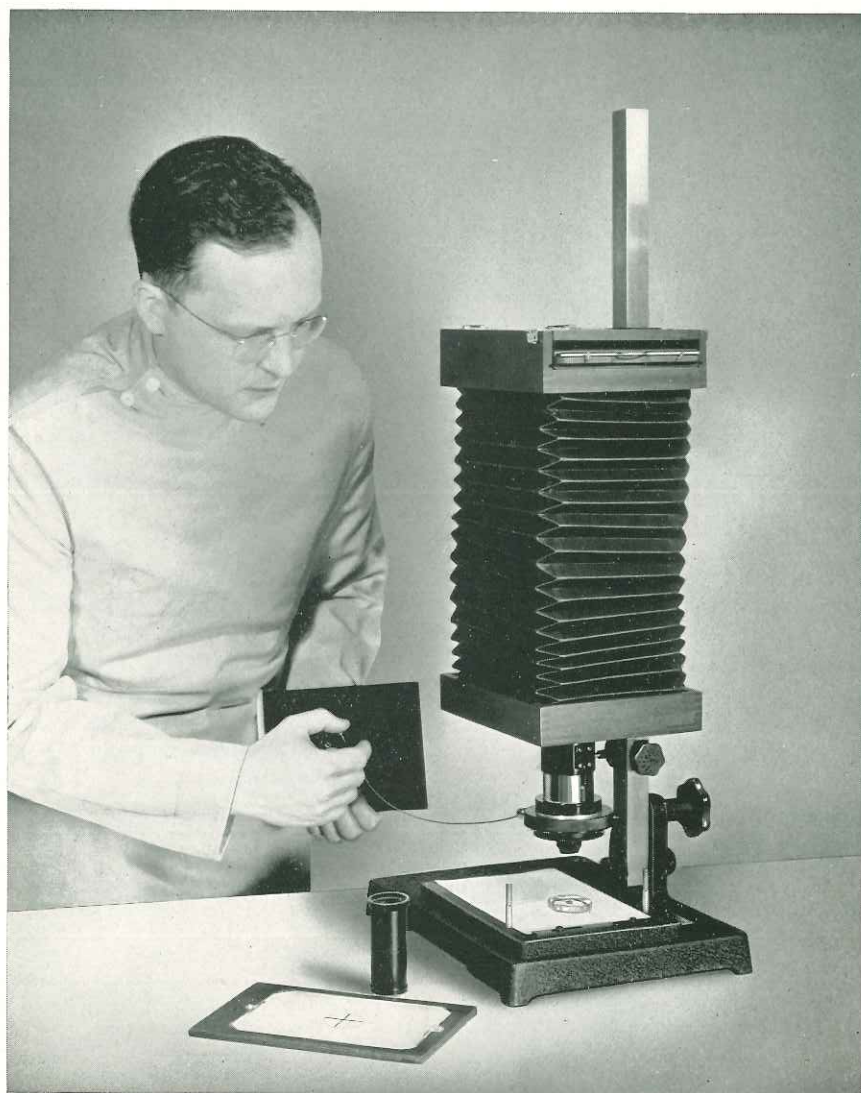
Micro Tessar and Tessar IIb Lenses

Micro Tessars are short focus lenses of the well known Tessar type designed especially for low power photomicrography. For the same magnification they are to be preferred over regular microscope

objective and eyepiece combinations whenever it is required to cover the largest possible area with a minimum of curvature of field. The superior flatness of field is obtained by reason of lower numeri-

cal aperture as compared to high power microscope objectives, and more complex construction as compared to ordinary low power microscope objectives. When operated at such camera extensions as to give a magnification of $10\times$, they work at a numerical aperture of 0.10 which is the same as the 32 mm achromatic microscope objective. But because of the simpler construction of the latter, aberrations of the margin of the field cannot be reduced as they are in the Micro Tessars. They are to be used without an eyepiece.

Type H Camera, equipped with compound shutter, rack and pinion focusing device and 48mm Micro Tessar, as used for laboratory photography and making photographs of objects at unit magnifications up to $10\times$.



They may be used for enlarging up to 50 or more diameters, depending on the available bellows draw of the camera. In using them for very low magnifications, it is advisable to reduce the aperture somewhat to secure the best definition, since they are designed to work to best advantage at somewhat higher magnifications.

These lenses are supplied in four convenient focal lengths. 72 mm, 48 mm, 32 mm and 16 mm. The 72 mm is supplied in a regular photographic lens barrel which by means of suitable adapters can be fitted directly to the lens board or shutter of the camera. The others are supplied in mounts threaded with the standard society screw thread so as to fit the regular microscope nose-piece, but suitable adapters are supplied so that they can be fitted to the lens board of the camera.

The 72 mm, 48 mm and 32 mm lenses are equipped with iris diaphragms, providing a control of the aperture from $f:4.5$ to $f:22.0$ for the 72 mm and 48 mm lenses and to $f:16.0$ for the 32 mm. The 16 mm

lens is made with the fixed relative aperture of $f:4.5$. Although the depth of focus of these Tessars is usually sufficient for most subjects, it may be increased for special cases by reducing the diaphragm aperture.

The diameter of field covered by the Micro Tessars depends upon conditions of illumination, focal length of the lens used, and the magnification at which it is used. Generally, at a given magnification, the field covered will result in an image greater than the available plate area.

Substage condensers of suitable diameter and focal length are needed to properly illuminate the full available field of the Micro Tessar lenses, when photographing transparent specimens.

A standard microscope stage with horseshoe base and mirror is listed, which accommodates these condensers. It has an inclination joint for use in either vertical or horizontal position. The stage will take the standard mechanical stage for moving the specimen.

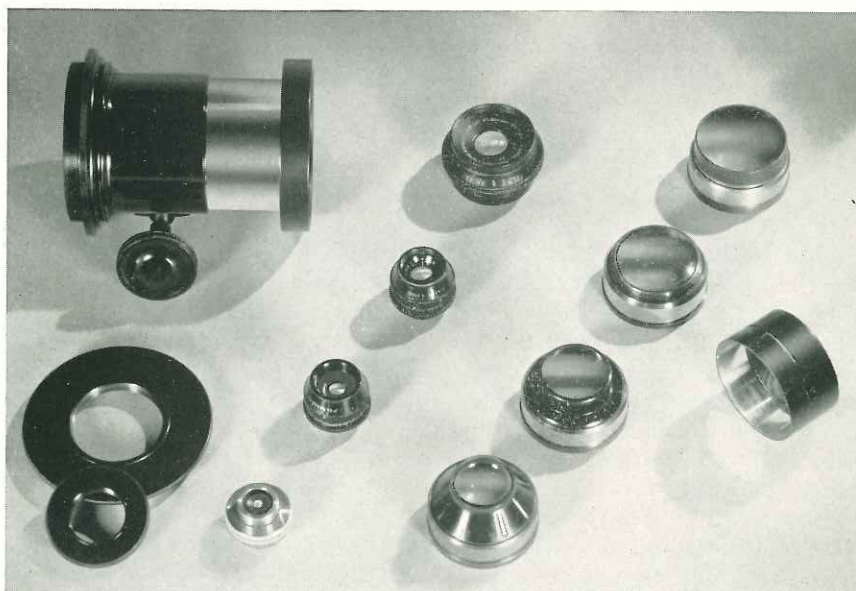
Tessar IIb Lens $f:6.3$

Tessar Series IIb is characterized by its ability to produce negatives possessing excellent, sharp images from center to margin of plate. Its remarkable definition adapts it to enlarging as well as to the finest grade of photography.

The table on page 27 gives the approximate object and image distances measured from the nearest surface of the lens in each case for magnifications up to $40\times$.

Using lenses of from 16 mm to 12 inches E.F., the upper figure is the object distance, the lower figure is the image distance.

For reduction, reverse position of lenses and interchange the object and image distances given in table.



Equipment for photo-macrography. Left to right, the rack and pinion focusing device, adapters, Micro Tessar lenses, substage condensers and substage ring.

MICRO TESSAR LENSES, $f:4.5$

Description	Catalog No.	Code Word
72mm ($2\frac{7}{8}$ ") Equivalent Focus.....	51-25-72-01	Dheft
48mm (2") Equivalent Focus.....	51-25-48-65	Dhegv
32mm ($1\frac{1}{8}$ ") Equivalent Focus.....	51-25-32-65	Dhehw
16mm ($\frac{5}{8}$ ") Equivalent Focus.....	51-25-16-03	Magim
Substage Condensers to fit in place of your Microscope Condenser		
For use with 72mm Micro Tessar to cover 31mm field..	42-47-07	Dhebp
For use with 48mm Micro Tessar to cover 22mm field..	42-47-08	Dhecr
For use with 32mm Micro Tessar to cover 15mm field..	42-47-09	Dheds
For use with 16mm Micro Tessar to cover 7mm field..	42-47-10	Dhazm
When the Micro Tessar Lens or combined lens and shutter are used on the camera, we recommend that they be mounted on a rack and pinion focusing mount.		
Rack and Pinion Focusing Mount, fitting front board of camera, and accommodating shutters or adapters for photographic lenses.....	42-16-38	Caasf
Adapter for fitting 72mm Micro Tessars and photo lenses to front of shutter or focusing mount.....	42-16-41	Carer
Adapter for use with 42-16-41 adapter to fit 16, 32 or 48mm Micro Tessars to shutter or focusing mount....	42-16-40	Caeds
Microscope Stage and Base for holding and illuminating transparent specimens; with reversible mirror and substage ring to hold Micro Tessar Condensers.....	31-50-34	Ajedj

TESSAR IIb, $f:6.3$

Focal Length Inches	Size of Plate Covered Inches	Lens and Barrel with Iris Diaphragm		In Compound Shutter without Barrel	
		Catalog No.	Code Word	Catalog No.	Code Word
$6\frac{1}{4}$	4 x 5	51-23-05-02	Hekim	51-23-05-91	Henir
$8\frac{3}{8}$	5 x 8	51-23-06-23	Helop	51-23-06-93	Henos
10	$6\frac{1}{2}$ x $8\frac{1}{2}$	51-23-07-24	Helur	51-23-07-93	Henut
12	8 x 10	51-23-08-25	Henep	51-23-08-94	Herit

Note: See page 27 for Table of Magnifications.

OPTICAL ACCESSORIES

Objectives, Eyepieces and Substage Condensers, for Visible Light

One of the most important considerations in photomicrography is the proper optical system for the work at hand. The camera is only a dark chamber with provision for holding the sensitized film or plate. The important work of forming an accurate image of an illuminated specimen on the sensitized material must be accomplished by the proper combination of eyepiece and objective. The photographic film or plate will record more than is seen visually. It will not accommodate for small differences of focus as do our eyes. The image must be sharp, free of color fringes, and undistorted when recorded. See chart on opposite page for the best eyepiece to use with the different objectives.

OBJECTIVES

Bausch & Lomb Optical Co. manufactures three types of objectives for standard laboratory microscopes—Achromatic, Fluorite and Apochromatic. All objectives have the lens elements mounted in threadless cells and burnished in so that they always remain perfectly centered—an exclusive Bausch & Lomb feature.

Achromatic

Achromatic objectives provide images of excellent quality with optical systems of the simplest possible type. Chromatic aberration is fully corrected for two colors and the spherical aberration generally for one. They are the universal objectives for visual work, and are very satisfactory in photomicrographic work when used in mono-

chromatic light. (See page 26 for color filters.)

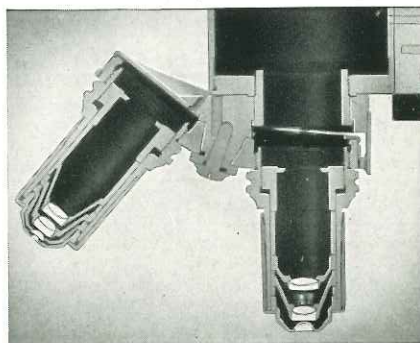
Fluorite

When better resolution is desired than can be obtained with Achromatic objectives, the Fluorite objectives are recommended as filling the need at moderate cost. They are excellent for use in photomicrography.

Apochromatic

The superiority of Apochromatic objectives over other types lies in their finer color correction, and the increase in usable numerical aperture that this makes possible. Chromatic aberration is corrected for three colors of the spectrum and spherical aberration for two colors, which means that practically all of the images produced by the different colors of the spectrum lie in the same plane and are equally sharp. The higher efficiency of the Apochromat—the absence of color halo—is appreciated most when focusing with central illumination

Illustrating objectives and revolving nosepiece construction.



on a black and white object, and by the appearance of such an object (Abbe test plate) under oblique illumination.

Although differently colored images lie in the same plane, they are of different sizes, which, with ordinary eyepieces, would give color fringes in the margin of the field. This difference, however, is neutralized by Compensating eyepieces, so that the combination of Apochromatic objectives and Compensating eyepiece gives a field free of color to the very margin.

The fact that the violet rays are brought to the same focus as visual rays makes these objectives excellent for photographic use, both for white light and monochromatic light. They should be used whenever color process work is being done.

Through extended investigations and computations, Bausch & Lomb has been able to improve the flatness of field of Apochromatic objectives to a remarkable extent, without impairing working distance and numerical aperture.

To obtain the full benefit of superior quality of these objectives, a tube length of 160 mm must be constantly maintained and the 3 mm and 4 mm dry objectives with correction collar must be carefully adjusted for the thickness of the cover glass used.

EYEPIECES

The microscope eyepiece magnifies the image of the object as formed by the objective. Four general types of eyepieces are manufactured—Huygenian, Hyperplane, Compensating, and Ampliplan.

Huygenian

The Huygenian eyepieces are commonly used for visual work, but are also satisfactory for photomicrography with low power objectives.

Hyperplane

Hyperplane eyepieces are featured by a flatter image plane than Huygenian eyepieces, which is greatly appreciated in photomicrography.

They have a color compensation about midway between the Huygenian and the Compensating eyepieces. This makes their use with high power Achromatic, Fluorite, and Apochromatic objectives extremely advantageous.

Compensating

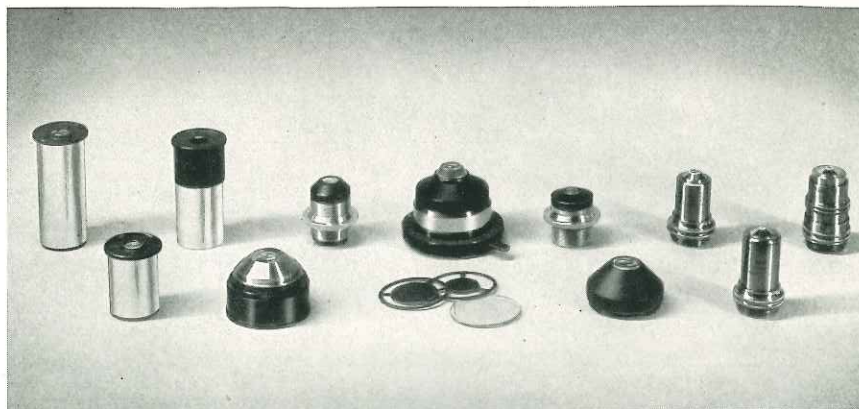
Compensating eyepieces are primarily corrected for use only with Apochromatic objectives. They are properly computed to eliminate the color fringes which are conspicuous when such objectives are used with ordinary eyepieces. The Compensating eyepiece balances the chromatic difference of magnification of the Apochromatic objective.

They can, however, be used successfully with the higher powers of Achromatic and Fluorite objectives, with good results.

Ampliplan

Ampliplans are negative lens combinations designed only for photomicrography and micro-projection to compensate for the curvature of field and for chromatic difference of magnification of the objectives. It is impossible for any eyepiece composed of positive lenses, such as the Huygenian eyepiece, to project the image formed by the objective which lies on a curved surface onto a screen or photographic plate without loss of definition towards the margin of the field.

In general, the curvature of field of a lens increases with its mag-



A group of eyepieces, objectives, and condensers

nification. Microscope objectives fall into three main groups successively as the magnification increases. For each group is offered an Ampliplan designated as "low," "medium" or "high," and indicates the group of objectives with which it should be used.

Ampliplans are so designed that they work equally well with Achromatic, Fluorite, and Apochromatic objectives. They cannot be used in visual work because the point corresponding to the ordinary eyepoint lies between the Ampliplan and the objective and the field of view that can be seen in any one position is exceedingly small.

For photomicrography they give a sharply defined image and in micro-projection are best used at short projection distances. The adapter that is necessary for fitting the Ampliplan to the microscope attaches in place of the standard eyepiece adapter and includes the microscope section of the light-tight sleeve for making a light-tight connection with the camera.

Ampliplans	E.F. in Objective
Low	16 mm
Medium	8 mm
High	4 mm
	1.9 mm

Recommended Objective and Eyepiece Combinations

Objective	Eyepiece for Visual or Photomicrographic Work	Eyepiece for Photomicrographic Work Only
48.0 mm. Achromatic Objective	Huygenian Eyepiece	
40.0 mm. Achromatic Objective	Huygenian Eyepiece	
32.0 mm. Achromatic Objective	Huygenian Eyepiece	
16.0 mm. Achromatic Objective	Huygenian Eyepiece	Ampliplan (Low)
8.0 mm. Achromatic Objective	Hyperplane Eyepiece	Ampliplan (Med.)
4.0 mm. Achromatic Objective	Hyperplane Eyepiece	Ampliplan (High)
1.9 mm.* Achromatic Objective	Compensating Eyepiece	Ampliplan (High)
4.0 mm. Fluorite Objective	Hyperplane Eyepiece	Ampliplan (High)
1.8 mm.* Fluorite Objective	Compensating Eyepiece	Ampliplan (High)
16.0 mm. Apochromatic Objective	Compensating Eyepiece	Ampliplan (Low)
8.0 mm. Apochromatic Objective	Compensating Eyepiece	Ampliplan (Med.)
4.0 mm. Apochromatic Objective	Compensating Eyepiece	Ampliplan (High)
2.0 mm.* Apochromatic Objective	Compensating Eyepiece	Ampliplan (High)

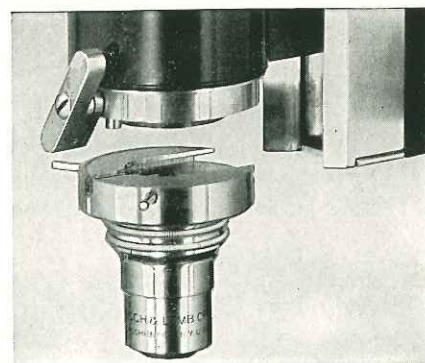
*Oil immersion objective.

OBJECTIVES

Achromatic						
Type	Initial Magnification	E.F. in mm.	N.A.	Working Dist. in mm.	Catalog Number	Code Word
Dry	4×	32	0.10	38.0	31-10-09-01	Abadk
	10×	16	0.25	7.0	31-10-22-01	Ailhy
	21×	8	0.50	1.6	31-10-27-01	Abagm
	43×	4	0.65	0.6	31-10-29-01	Abahn
	60×	3	0.85	0.2	31-10-35-01	Abakr
Water Immersion	44×	4	1.00	0.64	31-10-39-01	Addus
	81×	2.2	1.10	0.15	31-10-40-01	Adebr
Oil Immersion	97×	1.8	1.25	0.13	31-10-71-02	Aimwh
Fluorite						
Dry	43×	4	0.85	0.34	31-10-60-01	Abamt
Oil Immersion	98×	1.8	1.30	0.13	31-10-73-02	Ajonw
	98×	1.8	0.80	0.35	31-10-74-02	Ajolt
Apochromatic						
Dry	10×	16	0.30	4.85	31-11-21-01	Abbif
	20×	8.3	0.65	0.50	31-11-28-01	Afagy
	45×	4	0.95	0.18	31-11-31-01	Abbuu
	62×	3	0.95	0.13	31-11-35-01	Abcad
Oil Immersion	61×	3	1.40	0.12	31-11-39-02	Abcef
	90×	2	1.30	0.12	31-11-41-02	Abcig
	90×	2	1.40	0.07	31-11-43-02	Ahlul
	120×	1.5	1.30	0.08	31-11-45-02	Afref

EYEPIECES

Huygenian			
Magnification	Approximate E.F. in mm.	Catalog Number	Code Word
5.0×	50.0	31-15-05	Abapw
6.4×	40.0	31-15-06	Abarx
7.5×	33.0	31-15-07	Abasy
10.0×	25.0	31-15-10	Abatz
12.5×	20.0	31-15-12	Abavb
15.0×	16.7	31-15-15	Abezsh
Hyperplane			
5.0×	50.0	31-15-40	Abawc
7.5×	33.0	31-15-42	Abaxd
10.0×	25.0	31-15-44	Abayf
12.5×	20.0	31-15-46	Abazg
15.0×	16.7	31-15-48	Abbac
20.0×	12.5	31-15-50	Abbed
Compensating			
5.0×	50.0	31-15-70	Abcoh
7.5×	33.0	31-15-72	Abcuu
10.0×	25.0	31-15-75	Afahz
12.5×	20.0	31-15-76	Abdeg
15.0×	16.7	31-15-78	Abdih
25.0×	10.0	31-15-80	Abdoj
Ampliplans			
Magnification	Objective Designation	Catalog Number	Code Word
5×	Low	42-32-11	Cenez
5.5×	Medium	42-32-12	Cenib
6×	High	42-32-14	Cenoc
Adapter for DDE Microscope, 50 mm diam. body tube.....		42-34-11	Cenud
Adapter for G and H Microscopes, 39 mm diam. body tube.....		42-34-13	Ceojc
Adapter for F Microscopes, 35 mm diam. body tube.....		42-34-14	Cevih
Adapter for ILS Microscope.....		42-34-15	Cecip
Case, for Ampliplans.....		42-34-17	Ceobv



CENTERING NOSEPIECE

This centering nosepiece for a single objective permits quick interchange of any number of standard objectives. It provides means for accurate and rapid centering of the individual objective so that each may be replaced by another without disturbing the centering accomplished. It consists of two parts: the tube part, and the objective part. The tube part has the usual Society screw thread and attaches to the body tube. The objective part, one for each objective, contains the centering device worked by two keys. A locking lever completes the optical alignment of the two parts. The nosepiece is sturdily constructed and double chromium-plated to resist wear.

SUBSTAGE CONDENSERS

Critical conditions are encountered in illuminating a transparent microscopic specimen for photomicrography. Illumination that seems to be quite satisfactory for visual work does not necessarily produce good photomicrographs. First, it is necessary to have a homogeneous light source of good intensity, then a substage condenser to image this source on the specimen. To obtain the best resolution of detail, the cone of light passing through the specimen should fill the back lens of the objective completely, a con-

dition that is fulfilled only when the N.A. of the condenser is equal to or greater than the N.A. of the objective.

Three types of substage condensers are produced by Bausch & Lomb for bright field work in visible light—Abbe, Aplanatic and Achromatic.

Abbe Condenser

The Abbe condensers are available in two apertures, 1.25 and 1.40 N.A. This is the type of condenser usually included with the microscope. They are very satisfactory for visual work and can be used with a limited degree of success in photomicrography.

When the top element is removed from the 1.25 N.A. condenser, it has a numerical aperture of 0.30. When the top element is removed from the 1.40 N.A. condenser, the resulting N.A. is 0.70, and when the two upper elements are removed it is 0.40.

Abbe condensers fit into the simple rack and pinion substage and have an iris diaphragm and place for blue glass disc or dark ground stop.

Aplanatic Condenser

The Aplanatic condenser is a distinct improvement over the Abbe condenser, due to its excellent correction for spherical aberration which is perfect for all zones of the condenser. It has a numerical aperture of 1.40 and is separable. When the top element is removed, the resulting N.A. is 0.60, and when both upper elements are removed the N.A. is 0.40.

The quality of correction in each case is of high order. We do not recommend the 0.40 for lower power than 16 mm objectives.

Achromatic Condenser

While the Aplanatic condenser is corrected for spherical aberration,

the Achromatic condenser, 1.40 N.A., is corrected for both spherical and chromatic aberration.

This condenser is the most perfect type for use in bright field photomicrographic work, since its optical qualities approach those of the objective. It can be used with any type of optical system, but its use is particularly recommended where Apochromatic objectives are used for photomicrography.

The top element can be removed

from the Achromatic condenser, giving 0.66 N.A. for use with 16, 8, and 4 mm objectives.

Neither the Achromatic nor Aplanatic substage condensers are equipped with iris diaphragm. They are mounted for use on a research substage, which is equipped with an iris diaphragm.

An iris diaphragm can be attached to either condenser, if it is used in a simple rack and pinion substage.



*Aplanatic Condenser 31-58-38
with two upper elements removed*



*Achromatic Condenser 31-58-39
with top element removed*

Type	N.A. in Oil Im- mer- sion Con- tact	E.F. in mm.	Slide Thick- ness	Top Ele- ment Re- moved N.A.	With Two Upper Ele- ments Re- moved N.A.	Catalog Number	Code Word
Abbe Condenser*.....	1.25	9.9	1.8	0.30		31-58-74-28	Ajory
Abbe Condenser*.....	1.40	7.9	1.0	0.70	0.40	31-58-72-28	Abetb
Aplanatic Condenser**...	1.40	10.7	1.5	0.75	0.40	31-58-38	Abevc
Achromatic Condenser**.	1.40	9.2	1.0	0.66		31-58-39	Agzar

*For use on any Microscope with ring support attached directly to the stage or carried on the rack and pinion substages, such as B & L Types H and G. Outside diameter of condenser 38.6mm, equipped with iris diaphragm.

**For use with Research Type Substage having centering adjustment. This condenser attaches to a quick change slide. The iris diaphragm is not included since this is part of the complete substage.

When used without immersion oil (dry), any condenser of N.A. greater than 1.00 will furnish illumination not over 1.00 N.A.

Description	Catalog Number	Code Word
Iris Diaphragm, alone, to fit Aplanatic or Achromatic Con- densers when used in a substage ring.....	31-58-28	Agzes
Quick Changing Slide to hold a condenser in a research substage.....	31-58-09	Ainsr
Triple Nosepiece, revolving.....	31-19-03	Acmux
Quadruple Nosepiece, revolving.....	31-19-04	Acnat
Centering Nosepiece Tube part.....	31-19-07	Agyot
Objective part (one for each objective).....	31-19-08	Aharr

ULTRA-VIOLET OPTICS

and Accessories for Illumination

Ultra-violet Accessories for 365 μ offer an extremely convenient and comparatively inexpensive means of taking advantage of the superior resolution obtained when a short wave length of light is used for illumination. Ultra-violet is the only means of extending the range of the microscope. In reducing the

focal length of high powered objectives to 1.9 mm, the practical limits have been reached, since some working distance must be allowed. Aperture angle is widened to approximately its greatest degree by the use of immersion oil between the objective lens and the object. Therefore, there is but one element

within our power to change—the wave length of light.

The use of 365 μ ultra-violet is more practical, since the shorter wave lengths present two serious obstacles, namely: the finding of a material with the necessary physical characteristics that will allow it to be made into a lens, passing

Accessories for Ultra-Violet Photomicrography



ultra-violet light in sufficient intensity; and the difficulty of focusing an invisible ray. The resolution is 19% better than that obtained with the best microscope using visible light.

Visible Focusing

The optical system is of glass, and is corrected to focus both the 365 $\mu\mu$ ultra-violet and the visible 546 $\mu\mu$ wave lengths at the same point. Therefore, focusing is done in visible light and for that reason is positive.

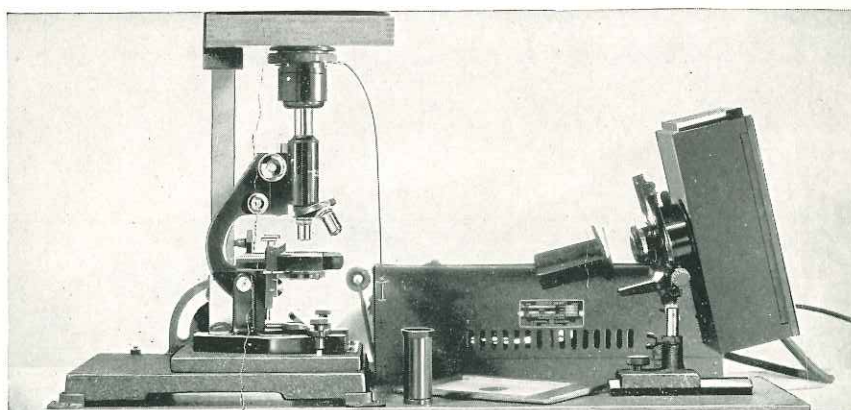
Selective Absorption of Ultra-Violet

The 365 $\mu\mu$ line is selectively absorbed by many substances, thus bringing out structural detail unobtainable by any other method. This is equally true of transparent and opaque materials.

Quartz Mercury Arc Lamp

The Quartz Mercury Arc Lamp is used for this ultra-violet work. It is a special design that gives very high emission in the ultra-violet spectrum. To focus for photography, the green filter provided with the accessories furnishes monochromatic green light. This is very practical, since the object can be seen with perfect ease through green. The eye is exceptionally sensitive to green light. After perfect focus is made, the U-V filter is substituted and the exposure is made on a photographic plate. Since the objectives for this use are achromatic for the two wave lengths—namely, 546 $\mu\mu$ and 365 $\mu\mu$ —the image formed on the photographic plate is as sharp as that seen by the eye.

Sandalwood oil is used in place of cedar oil for the immersion objective.



Showing an Equipment for Ultra-Violet Photomicrography

Specifications	Catalog Number	Code Word
Achromatic Objectives for Transparent Objects		
Objective corrected for 365 $\mu\mu$, 16 mm, 0.25 N.A., dry.....	31-10-23-01	Agujk
Objective corrected for 365 $\mu\mu$, 6 mm, 0.65 N.A., dry.....	31-10-46-01	Agulm
Objective corrected for 365 $\mu\mu$, 1.7 mm, 1.30 N.A., oil. Including bottle of sandalwood oil.....	31-10-45-04	Agukl
Stage Accessories		
Quartz Condenser, Abbe type, with iris diaphragm.....	31-51-20	Agugh
Corex Slide.....	31-73-81	Adpud
Lamps and Accessories		
UV Accessories for use on Types GB and R Cameras, including lamp housing, Uviarc burner, resistance for 110 volt, D.C., quartz condenser, 2 filters (visual and photographic), filter holder, in case.....	42-44-01-21	Ceepg
UV Accessories, the same as above, but with auxiliary for use on 110 volt, A.C.....	42-44-02-22	Ceerh
UV Accessories for JR Camera, with resistance for 110 volt, D.C., same as above, but with lamp house support with vertical, adjustable post and inclination joint.....	42-44-01-41	Ceevl
UV Accessories for Type JR Camera, but for 110 volt, A.C.....	42-44-02-42	Ceexn
UV Accessories for Types H, J and K Cameras, for 110 volt D.C., same as above, but lamp has pedestal base.....	42-44-01-51	Ceezr
UV Accessories for Types H, J, and K Cameras, same as above, but for 110 volt, A.C.....	42-44-02-52	Cefap
Achromatic Objectives for Opaque Objects		
Objective corrected for 365 $\mu\mu$, 16 mm, 0.25 N.A., dry.....	42-32-23	Cebal
Objective corrected for 365 $\mu\mu$, 6 mm, 0.65 N.A., dry.....	42-32-46	Cebem
Objective corrected for 365 $\mu\mu$, 1.7 mm, 1.30 N.A. oil. Including bottle of sandalwood oil.....	42-32-45-08	Cebin
Lamps and Accessories		
UV Accessories for use with Type ILS Microscope and Camera, or Metallographic Outfit, including lamp housing, Uviarc burner, resistance for 110 volt, D.C., condenser, collective, 2 filters (visual and photographic), filter holder, in case.....	42-44-01-01	Cefer
Same as above but with transformer for 110 volt, A.C.....	42-44-02-02	Cefis
Burners		
Uviarc Burner, for 110 volt, D.C.....	42-42-01	Ceenf
Uviarc Burner, for 110 volt, A.C.....	42-42-02	Ceemd
Filters		
Two Filters (visual and photographic).....	42-47-73-74	Cegar
Immersion Oil		
10 cc. bottle of sandalwood oil.....	31-50-08	Agufg

Miscellaneous Accessories

STAGE MICROMETERS		
Description	Catalog Number	Code Word
Stage Micrometer, glass, ruled to 0.001 inches.....	31-16-89	Ahgab
Stage Micrometer, glass, ruled to 0.01 mm.....	31-16-90	Ahurw
FOCUSING GLASSES		
Doublet Focusing Glass 3.5×.....	42-15-86	Cavuy
Achromatic, Adjustable Focusing Glass 7×.....	42-15-84	Cawav
COMPOUND SHUTTER		
Compound Shutter.....	42-16-32	Caajw
GROUND GLASSES (UNMOUNTED)		
Ground Glass 5" x 7".....	42-14-95-012	Chanh
Ground Glass 8" x 10".....	42-14-90-012	Chalf
Ground Glass 5" x 7" with clear center.....	42-14-95-013	Chapj
Ground Glass 8" x 10" with clear center.....	42-14-90-013	Chamg
WRATTEN FILTERS		
Orange-Red From 5900 to Red End.....	42-47-90	Caobs
Green From 4800 to 6200.....	42-47-91	Caoct
Blue-Violet From 3700 to 5100.....	42-47-92	Caodv
Purple From 3200 to 4700 and from 6500 to Red End.....	42-47-93	Caofw
Orange From 5500 to Red End.....	42-47-94	Caohy
Pure Red From 6100 to Red End.....	42-47-95	Caolz
Strong Yellow From 5100 to Red End.....	42-47-96	Caokb
Blue From 4300 to 5400.....	42-47-97	Caolc
Pale Green For Orthochromatic reproduction with tungsten light.....	42-47-98	Caomd
Complete set of "M" filters as listed above, in case.....	42-47-99	Caonf
SINGLE PLATE HOLDER		
For 8" x 10" plates, including kits for 5" x 7", 4" x 5" and 3 1/4" x 4 1/4" plates, book form.....	42-15-17	Caizp
DOUBLE PLATE HOLDERS		
For 4 x 5" plates.....	42-15-22	Cajol
For 5 x 7" plates.....	42-15-23	Cajum
For 5 x 7" plates, with kits for 4 x 5.....	42-15-23-04	Chasl
For 5 x 7" plates, with kits for 4 x 5 and 3 1/4 x 4 1/4.....	42-15-23-03	Chark
For 8 x 10" plates.....	42-15-26	Cakom
For 8 x 10" plates, with kits for 5 x 7.....	42-15-26-05	Chawp
For 8 x 10" plates, with kits for 5 x 7 and 4 x 5.....	42-15-26-04	Chavn
For 8 x 10" plates, with kits for 5 x 7, 4 x 5 and 3 1/4 x 4 1/4.....	42-15-26-03	Chatm
SOFT CORED CARBONS		
Carbons—cored 8 mm diameter, 6" long for D.C. per 10.....	41-42-72	Dezep
Carbons—cored 6 mm diameter, 6" long for D.C. per 10.....	41-42-73	Dezir
Carbons—cored 7 mm diameter, 6" long for A.C. per 10.....	41-42-81	Daibv
BULBS		
6-volt, 108-watt Ribbon Filament Bulb, prefocus base.....	42-42-36	Cejat
Tungsten Arc Bulb.....	42-42-60	Chegb
RESISTANCES AND TRANSFORMERS		
Resistance fixed form, 4.5 amperes, for use with arc lamp, 115 volt D.C. or A.C. With cord.....	42-46-52-25	Chajc
Resistance fixed form, 4.5 amperes, for use with arc lamp 220 volt D.C. or A.C. With cord.....	42-46-53-25	Cenay
Resistance fixed form, 8 amperes, for use with arc lamp 115 volt D.C. or A.C. With cord.....	42-46-57-25	Chakd
Transformer for 6 volt, 108 watt bulb on 115 volt, 60 cycle A.C.....	42-46-97	Ceihz
Transformer, same as above but for 220 volts.....	42-46-98	Dicuh
Transformer, for 115 volt, 25 cycles.....	42-46-91	Cevuk
Transformer for use of Tungsten Arc Bulb on 115 volt, 60 cycle A.C.....	42-46-92	Chehc

Stage Micrometers

Stage Micrometers are essential for accurate calibration of eyepiece micrometers. They are graduated in both the inch and metric systems. The graduations are finely ruled lines on a polished glass slide, 25 x 75 mm, and are protected by a polished cover glass, cemented over them.

Focusing Glasses

When focusing images of very fine structure, a focusing glass placed on a clear glass focusing screen or clear glass center of a focusing screen enables one to focus the image more critically than by the eye.

This Bausch & Lomb doublet focusing glass is designed for photomicrographic work and gives 3.5× magnification.

Compound Shutter

With the Compound Shutter, instantaneous, bulb, or time exposures can be made. It has steel leaves with a maximum opening of 40 mm.

Ground Glasses

These ground glasses are finely ground on one side, ruled with perpendicular black cross lines, 38 mm long in the center of the plate. They are supplied plain and with a clear spot of 38 mm diameter. They are approximately 2 mm thick.

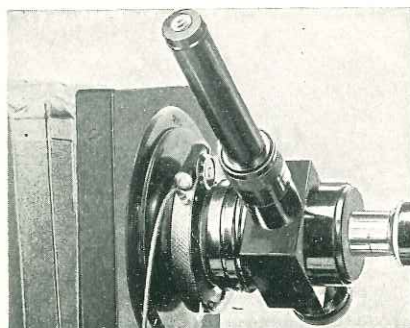
Mechanical Feed Arc Lamp

The Bausch & Lomb Mechanical Feed Arc Lamp provides a light beam of greatest shaded intensity. It is adapted to all types of photomicrography, visual microscopy, and dark field work with the Cardioid condenser. Similar to the lamp illustrated on page 9, except that it has a pedestal base.

The Observation Eyepiece

The Observation eyepiece may be used between the microscope and camera when these are aligned and connected for photomicrography. It has two functions, first, for exploring a slide to locate the particular field to be photographed, or observing a live specimen during exposure; second, for focusing the image of the specimen in the plane of the photographic plate without having to use the focusing screen. This is possible only after it has first been calibrated for the particular bellows extension at which photographs will be made.

The eyepiece is obtainable as an accessory, and is attached to the camera front board or, if a shutter is used, to the front of the shutter. Since it is supported from the camera, its weight is not imposed on the fine adjustment of the microscope. If desired, the beam-splitting prism may be withdrawn from the optical axis before exposures are made. It



may be used on all the cameras is regularly equipped with an eye-described except the type K which piece.

Description	Catalog Number	Code Word
Mechanical Feed Arc Lamp, fitted with ASPHERIC condenser, with water cell holder and filter holder including fused Pyrex water cell. Without resistance.....	31-33-81-64	Ajahn
Mechanical Feed Arc Lamp, same as above except with spherical condenser. Without resistance	31-33-81-65	Ajalp
Observation Eyepiece as described.....	42-16-67	Calup

See opposite page for Resistances.

Table of Magnifications for the Micro Tessars

Using lenses of from 16 mm to 12" E.F. The upper figure is the Object distance. The lower figure is the Image distance.

For reductions, reverse position of lens, and interchange the object and image distances given in table. To compute approximate object and image distance use the following formula: $U = F \left(1 + \frac{1}{M} \right)$, $V = F (1 + M)$. U is object distance, V image

distance, F focal length and M magnification.

Magnification	MICRO TESSAR				TESSAR IIb					
	16mm	32mm	48mm	72mm	4 5/8"	5 1/4"	6 1/4"	8 3/8"	10"	12"
	in mm	in mm	in mm	in mm	in mm	in mm	in mm	in mm	in mm	in mm
1 ×	30 31	60 62	90 93	135 139	226 237	251 263	298 313	402 422	484 507	573 601
2 ×	22 47	44 94	67 141	100 211	167 357	185 397	220 471	297 635	357 763	423 905
3 ×	20 63	39 126	59 189	88 284	147 476	163 530	194 629	261 848	314 1019	372 1209
4 ×	18 79	36 158	55 238	82 356	137 596	152 663	181 787	244 1061	293 1275	347 1512
5 ×	17 95	35 191	52 286	78 429	131 715	145 796	173 945	233 1274	280 1531	332 1815
6 ×	17 111	34 223	51 334	76 501	127 835	141 929	168 1105	226 1487	271 1787	322 2119
7 ×	16 125	33 250	49 375	74 562	124 955	138 1062	164 1261	221 1700	265 2043	315 2422
8 ×	16 144	32 287	49 431	73 646	122 1074	135 1195	161 1419	217 1913	261 2299	310 2726
9 ×	16 160	32 319	48 479	68 719	120 1194	134 1328	159 1577	214 2126	257 2555	305 3030
10 ×	16 176	32 352	47 527	67 791	119 1314	132 1462	157 1735	212 2339	254 2811	301 3333
15 ×	15 256	30 513	46 769							
20 ×	15 337	30 674	45 1011							
25 ×	15 417	30 835								
30 ×	15 498	29 996								
40 ×	15 659									

TERMS

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Price List for Catalog E-21

PHOTO-MICROGRAPHIC EQUIPMENT

October 15, 1937

Prices herein are subject to change without notice and to addition or increase for applicable taxes, excises or other charges imposed by any governmental authority with respect to the articles listed herein or to the sale, use or consumption thereof.

BAUSCH & LOMB

OPTICAL COMPANY , , ROCHESTER, N. Y.

Catalog No.	Code Word	Price	Catalog No.	Code Word	Price	Catalog No.	Code Word	Price
Page 6			Page 14			Page 19 (Con.)		
42-14-44-11	Cases	\$105.00	42-18-48-12	Caduh	Prices on request \$ 33.00 575.00 682.50	51-23-07-24	Helur	\$ 74.00
42-15-39	Casit	2.75	42-18-48-45	Chefz		51-23-08-25	Henep	123.00
42-15-38	Casov	5.50	31-59-59	Ajils		51-23-05-91	Henir	51.50
42-44-97-66*	Caopg*	39.50	31-24-57-12	Adutm		51-23-06-93	Henos	86.25
42-47-23	Chaxr	2.75	31-24-57-18	Aduvn		51-23-07-93	Henut	106.75
*Aspheric Condenser, \$8.50 extra.						51-23-08-94	Herit	166.00
Page 7			Page 15			Page 22		
42-14-36-05	Caacp	160.00	42-63-66	Dilal	45.00	31-10-09-01	Abadk	7.00
42-14-36-01	Calim	100.00	42-65-68-01	Cewok	20.00	31-10-22-01	Ailhy	9.00
42-16-32	Caajw	25.00	42-65-70-62	Cewul	25.00	31-10-27-01	Abagm	15.25
Page 8			42-44-97-09	Dhipf	35.30	31-10-29-01	Abahn	17.00
42-14-14-07	Caard	140.00	31-33-81-03	Actez	55.00	31-10-35-01	Abakr	20.00
42-16-32	Caajw	25.00	42-46-52	Cewag	8.50	31-10-39-01	Addus	36.00
42-44-97-65	Cezim	48.00	42-46-57	Cekoy	10.75	31-10-40-01	Adebr	50.00
42-47-23	Chaxr	2.75	Page 17			31-10-71-02	Aimwh	35.00
Page 9			42-14-60-23	Cexah	225.00	31-10-60-01	Abamt	32.00
42-14-14-37	Caavh	255.00	42-16-70	Cexik	45.00	31-10-73-02	Ajonw	58.00
42-14-14-27	Caaxk	275.00	42-16-71-01	Cexol	49.00	31-10-74-02	Ajolt	58.00
42-14-14-92	Chays	308.50	42-16-72-02	Cexum	47.00	31-11-21-01	Abbif	32.50
42-16-32	Caajw	25.00	42-16-73-04	Ceyaj	49.00	31-11-28-01	Afagy	49.00
Page 12			42-16-74-07	Ceyek	41.00	31-11-31-01	Abbuh	65.00
42-16-59	Chocz	250.00	42-16-75-11	Ceyil	41.00	31-11-35-01	Abcad	70.00
42-14-07-35**	Caorh	560.00	42-16-76-24	Ceyom	35.00	31-11-39-02	Abcef	135.00
42-14-07-92	Chazt	593.50	Page 19			31-11-41-02	Abcig	86.00
42-14-07-10	Caotk	540.00	51-25-72-01	Dheft	44.00	31-11-43-02	Ahlul	135.00
42-14-08-35**	Caosj	640.00	51-25-48-65	Dhegv	36.00	31-11-45-02	Afref	110.00
42-14-08-92	Chebvw	673.50	51-25-32-65	Dhehw	36.00	31-15-05	Abapw	3.00
42-14-08-10	Caovl	620.00	51-25-16-03	Magim	25.00	31-15-06	Abarx	3.00
**For use on A.C. an 8-ampere resistance is recommended. Price \$2.25 extra.			42-47-07	Dhebp	6.00	31-15-07	Abasy	3.00
			42-47-08	Dhecr	6.00	31-15-10	Abatz	3.00
			42-47-09	Dheds	6.00	31-15-12	Abavb	3.00
			42-47-10	Dhazm	6.00	31-15-15	Abezsh	4.50
			42-16-38	Caasf	15.00	31-15-40	Abawc	7.25
			42-16-41	Carer	3.50	31-15-42	Abaxd	7.25
			42-16-40	Caeds	2.50	31-15-44	Abayf	10.25
			31-50-34	Ajedj	25.00	31-15-46	Abazg	10.25
			51-23-05-02	Hekim	30.50	31-15-48	Abbac	10.25
			51-23-06-23	Helop	53.50	31-15-50	Abbed	10.25
						31-15-70	Abcoh	7.25
						31-15-72	Abcu	7.25
						31-15-75	Afahz	10.25
						31-15-76	Abdeg	10.25

Catalog No.	Code Word	Price	Catalog No.	Code Word	Price	Catalog No.	Code Word	Price
Page 22 (Con.)			Page 25			Page 26 (Con.)		
31-15-78	Abdih	\$10.25	31-10-23-01	Agujk	\$13.50	42-47-92	Caodv	\$ 1.75
31-15-80	Abdoj	10.25	31-10-46-01	Agulm	27.50	42-47-93	Caofw	1.75
42-32-11	Cenez	22.00	31-10-45-04	Agukl	40.00	42-47-94	Caohy	1.75
42-32-12	Cenib	22.00	31-51-20	Agugh	37.50	42-47-95	Caobjz	1.75
42-32-14	Cenoc	22.00	31-73-81	Adpud	2.50	42-47-96	Caokb	1.75
42-34-11	Cenud	3.50	42-44-01-21	Ceepeg	153.50	42-47-97	Caole	1.75
42-34-13	Ceoje	3.50	42-44-02-22	Ceerh	188.50	42-47-98	Caomd	1.75
42-34-14	Cevih	3.50	42-44-01-41	Ceevl	175.00	42-47-99	Caonf	20.00
42-34-15	Cecip	3.50	42-44-02-42	Ceeen	210.00	42-15-17	Caizp	16.30
42-34-17	Ceobv	4.50	42-44-01-51	Ceezr	178.00	42-15-22	Cajol	3.00
Page 23			42-44-02-52	Cefap	213.00	42-15-23	Cajum	2.75
31-58-74-28†	Ajory	12.50	42-32-23	Cebal	14.50	42-15-23-04	Chasl	3.55
31-58-72-28†	Abetb	14.50	42-32-46	Cebem	29.00	42-15-23-03	Chark	4.25
31-58-38††	Abevc	30.00	42-32-45-08	Cebin	45.00	42-15-26	Cakom	5.50
31-58-39††	Agzar	30.00	42-44-01-01	Cefer	162.00	42-15-26-05	Chawp	6.70
31-58-28	Agzes	5.00	42-44-02-02	Cefis	197.00	42-15-26-04	Chavn	7.50
31-58-09	Ainsr	2.75	42-42-01	Ceenf	84.00	42-15-26-03	Chatm	8.20
31-19-03	Acmux	9.00	42-42-02	Ceemd	90.00	41-42-72	Dezep	per ten { .60
31-19-04	Acnat	11.00	42-47-73-74	Cegap	10.00	41-42-73	Dezir	{ .60
31-19-07	Agyot	12.50	31-50-08	Agufg	1.00	41-42-81	Daibv	{ .60
31-19-08	Aharr	5.00	Page 26			42-42-36	Cejat	6.25
†For use on any Microscope with ring support attached directly to the stage or carried on the rack and pinion substage such as B & L Type H and G. Outside diameter of condenser 38.6 mm, equipped with iris diaphragm. ††For use with Research Type Substage having centering adjustment. This condenser attaches to a quick change slide. The iris diaphragm is not included since this is part of the complete substage. When used without immersion oil (dry), any condenser of N.A. greater than 1.00 will furnish illumination not over 1.00 N.A.			31-16-89	Ahgab	8.00	42-42-60	Chegb	10.00
			31-16-90	Ahurw	7.00	42-46-52-25	Chajc	11.50
			42-15-86	Cavuy	5.00	42-46-53-25	Cenay	13.50
			42-15-84	Cawav	6.50	42-46-57-25	Chakd	13.75
			42-16-32	Caajw	25.00	42-46-97	Ceihz	10.00
			42-14-95-012	Chanh	2.25	42-46-98	Dicuh	13.50
			42-14-90-012	Chalf	3.00	42-46-91	Cevuk	12.50
			42-14-95-013	Chapj	4.00	42-46-92	Chehc	40.00
			42-14-90-013	Chamg	5.00	Page 27		
			42-47-90	Caobs	1.75	31-33-81-64	Ajakn	72.50
			42-47-91	Caoct	1.75	31-33-81-65	Ajalp	67.50
						42-16-67	Calup	40.00

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THE Bausch & Lomb Optical Company manufactures many types of optical equipment not listed in this catalog. If you have a special optical problem, it is probable that an instrument of standard manufacture can be adapted to your use at moderate cost. New instruments are being developed continually to handle unusual problems. Below are listed some of the many Bausch & Lomb Products in regular production. Send for literature on lines that interest you.

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Slit-Ultra Microscope
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Colorimetric Apparatus
Density Comparator
Opacimeter
Photometers
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Orthogon Test Lens Set
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